Welcome to the April 5th, 2017 Edition of THE REVENGE HUMP DAY!

So far, this has been a very calm week for me. And after the last few months I have had, I'll take this as a win. The only bad thing is that I am suffering from Pollenagedeon around her from our spring tsunami of pollen. My ears are plugged and my sinuses ache from all of the pollen. I long for rainy days just to clear the air.

LibertyCon is coming right a long and it looks to be a good one. Rich is starting to put the finishing touches to this first draft of the programming schedule and we hope to have it posted pretty soon. There should be at least 4 tracks of programming going on most of the time. One thing I can tell you is that we will start programming a little earlier on Friday so that some of you who pickup your badges early will have something to do.

Last year I guilted Matt into sitting in the convention center on Thursday evening and handing out badges while we are setting up the facility for the next day. Since we have already sold out for this year, I think I am going to try to get him to do it again.

About the biggest change in the function space for the convention that I know about is that Rich Groller and I did some horse trading about spaces. I traded him the American Car where I held the Spades Tournament last year got Gallery B. So, for us Spades players, that means that we will be holding the tournament in the Main Convention Center right near the registration area. Also, we will be breaking the first round of the tournament into two different times. The first will be 9:30 pm on Friday and the second at 11:00 pm. It worked well last year and I think it will be great this year. About the only rub we have playing cards in the convention center is on Sunday. But I have that one figured out also. On Sunday afternoon, we will be playing cards over in the Southern Room in Building One after the convention. Also, we can eat in there so we can snack and play cards to our hearts content.

So on that "happy note", why don't y'all sit back and relax because here's the best in gossip, jokes and science for your reading pleasure!

Uncle Timmy

<G>~<O>~<S>~<S>~<I>~<P>~~~<S>~<T>~<A>~<R>~<T>~<S>~~~<H>~<E>~<R>~<E>~<!>

I NEED YOUR HELP IN A SCIENTIC EXPERIMENT

From: "Dr.Robert Hampson" rhampson@wakehealth.edu

Dear Friends and Colleagues:

Last year, the Hampson Laboratory Webpage (http://hampsonlab.org), conducted a survey of 500 pictures. We received over 1100 individual responses, for which we are extremely grateful to all who participated, and the people who rallied their own social media groups to our benefit.
This year we have another 500 pictures to classify. We are asking for volunteers to go to the http://hampsonlab.org/ page and take a survey consisting of 25 images from our set.

Our laboratory is identifying "categories" and/or "features" of pictures that we use to examine how the brain encodes information according to a number of different

characteristics - is it a cartoon? Photograph? Silhouette or drawing? Is it in color or black & white - if color, which colors? Are there specific items visible in the picture?

We know that different people categorize pictures in different ways. Thus, we need to conduct a survey of as many people as possible to find the most likely common classification from a fixed set of categories.

There are instructions and hints on the URL web page (http://hampsonlab.org). Clicking on "Take the Survey" will bring up a random selection of 25 pictures. Enter your responses by clicking next to the features that you think fit the image. The listed features will not perfectly suit all pictures. We know this. The features were chosen for reasons based on the psychology and physiology of human memory. Therefore, we ask that you choose the closest match(es) from the list of options. At the end of the page, "Submit" the Survey, and your responses will be written to our server.

If you have time, click on "Take Another Survey" and the webpage will return to the beginning. Each time you click "Take the Survey," you should see a new page of 25 pictures. [You can choose your survey page by bypassing the default screen and editing the URL to read:

http://hampsonlab.org/v3Survey1.html , ...v3Survey2.html, ...v3Survey3.html, etc.

through ...v3Survey20.html. Again, all results are logged on our server automatically once you select "Submit."]

Disclaimer: The survey is completely anonymous - we record only the picture name and 1's or 0's representing your choices (you can briefly see the data in the box on the Submit page). All pictures in the survey are purchased or used under fair use, non-commercial research purposes only. Your response data contains no personal information. We conduct no diagnosis or analysis of the participants or individual responses. The data is used solely to develop anonymous population classifications.

Thank you for participating in the survey. We appreciate your help.

There is also an FAQ file at: https://www.facebook.com/notes/tedd-roberts/faq-for-the-image-categorization-survey/1540802825931128

<L>~<I>~<B>~<E>~<R>~<T>~<Y>~<C>~<O>~<N>

Michael Thomas Townsend May 16, 1944 - March 25, 2017

From: "Randall McPherson" randall.mcpherson@tn.gov

Michael Thomas Townsend

Born in Dallas, Texas on May 16, 1944. Departed on March 25, 2017 and resided in Nashville, Tennessee

Graveside Service: Thursday March 30, 2017 1:00pm

Preceded in death by his parents, Frank and Ann Townsend.

Survived by his brothers, Frank (Terry) Townsend, Arthur Townsend and Thomas Townsend; sisters, Pamela (Dennis) Eaton and Winona Quirk; step-mother, Audrey Townsend.

A graveside service will be at 1 p.m. on Thursday, March 30, 2017 at Woodlawn Memorial Park.

Arrangements by Harpeth Hills Funeral Home (615) 646-9292 www.harpethhills.com

https://www.harpethhills.com/obit/michael-thomas-townsend/

<L>~<I>~<B>~<E>~<R>~<T>~<Y>~<C>~<O>~<N>

PLANETARY STORIES 39 DELAYED

From: "Shelby Vick" planetarystories@gmail.com

Shelby Vick is having eye surgery which might take months to heal. Authors and Artists be aware that your submissions will be kept for later decision. Assistant editor Robert Kennedy, artist Tim Riley and daughter Cheryl Good will help get PS39 online, but it will be delayed.

<L>~<I>~<B>~<E>~<R>~<T>~<Y>~<C>~<O>~<N>

KENNEDY RIDES AGAIN TO LAKE VICTORIA IN AFRICA

From: "Robert @ Work Kennedy" Robert.Kennedy@tetratech.com

Greetings from Lake Victoria

Well, I spent most of January sick, in hospital, or recovering from surgery, which is why I dropped off the radar for awhile.

In early February, the surgeon gave me the green light to travel on airplanes again, so with some trepidation, I took off for Uganda. Well, than turned out to be brilliant, way more fun than expected, and I want to go back. Story below.

[snip] RGK3

Greetings from the Ministry of Energy & Minerals office complex, atop Government Hill overlooking Lake Victoria. (I grant you that the view would be prettier without the concertina wire.) Quite exotic here. Lots of camouflaged soldiers w/AK47s, here and at the airport. Customs/Immigration/Health (first time I've ever been asked to produce my Yellow Card) was a breeze - I was out and on my way with my driver in 15 minutes. But ubiquitous armed guards take their jobs seriously. Even at the hotel, they're very polite but you still go thru the metal detector and everything gets looked at. There's even a camo dude with a well-used Kalashnikov patrolling inside the walled parking lot of the hotel 24/7.

Birds abound on Government Hill -- big white storks and huge stately black I-don't-know-what (meter-plus wingspans, cranes maybe? 17Feb17 note: no, they are storks too, called

"maribu storks" and they're carrion eaters with the basic habits/behavior of vultures, which is kinda creepy) perched on the red tile rooftops, and vast swarms of swallow-like birds swirling overhead ceaselessly, catching their brekkie (*clouds* of mosquitoes) on the wing. Indefatigable protectors of my health! I cheer them on.

Uganda sits on the "Western Arm" of the great African Rift system, which is why we are here. (Geothermal energy.) Dirt is red like Tennessee's, but far more fertile, being volcanic in origin. Wherever it isn't red, it's intense green. Termite mounds everywhere. Pretty hot and humid too, but the air is clean and there is usually a fresh breeze off the lake. My new friends tell me that the first of two annual rainy seasons is about to start.

The accommodations that the Brits laid on are first-rate, more modern than most anywhere I've stayed in the States. You turn on the power by putting your room key in a slot next to the door, Asian-style. Bathroom is sybaritic--way better than my own! Traffic out here by the airport / lake is just fine, and MEMD is just minutes from our hotel. But I've heard tell that the commute from "downtown" Kampala (a giant sprawl that the jet took 10 minutes to fly over) is a 2-hour to 5-hour (!!!) ordeal. Our programme manager Bridey (the Aussie with the Navajo husband, who knows my solar Client Wenona back in New Mexico, imagine that!) is a pistol. One thing you want to do when flying this far is to arrive a day ahead of time in order to acclimatize. We landed in Addis at 7 in Sunday morning, rolling past an ancient pair (WWII-era) of DC-3 aka C-47s on the taxiway. On the next trip, I'll be ready and snap a picture. They are dusty and missing parts; clearly these would not be my ride to Entebbe. That was a well-used 737, once again playing the hippest coolest boarding music (it's called "Ethio-jazz") that you ever heard. Habit forming. We were on the ground in Entebbe by noon-ish, and I was in bed by 2 PM. That 4-hour nap was such a blessing.

People are kind, friendly, *very* soft-spoken, polite, obviously educated. They speak the Queen's English with a charming African lilt. Everyone has *exquisite* handwriting and penmanship--there must be good primary education here. (Confirmed.) Lots of Biblical

given names, Old Testament and New, with tribal surnames. One strange cultural element—the geoscientists in the audience kept addressing me as "Kennedy", which I thought was a bit brusque, but I just rolled with it. Turns out that, among Ugandans, addressing someone by their surname without titles is actually a gesture of respect. Alas, my Swahili isn't going quite as far as I expected. The girls understand me but giggle. One of them actually asked me for Swahili advice, can you imagine! Oy.**

**** (Swahili is not as common or as useful as I thought it would be. After several days of funny reactions from people, they told me at the party that, to people of the African interior like Ugandans, Swahili is associated with Arab raiders, slave traders, and all sorts of unpleasant foreign/border things, including the one war with Tanzania back during the days of Idi Amin. My books and Wikipedia didn't mention any of this. So I've dropped the Swahili and am picking up some Luganda instead.)**

Food is excellent, spicy, lots of Indian (dot not feather) influence. Somozas, curries, other South Asian cuisine. As I have come to expect in East Africa, breakfast at the hotel is simply superb, far richer and more diverse than anything I ever see in the States. Our on-the-ground organizer/fixer Lorna caters in hot lunch to the Workshops, and that's when I see traditional African fare like manioc, millet patties, banana, rice, fish, lamb, goat, etc. The hotel restaurant prepares fine dinners too, and one really doesn't need to venture out. (The parking lot of the one fancy Western-style offsite restaurant we visited was full of white SUVs with a prominent "UN" on the door, and corny country music playing inside. The place bugged me on a couple levels.) Local brew ("Nile Special") is good and cold. Signs openly advise not to drink tap water, so the suds is my preferred form of hydration. Nice big bottles, too. Coffee good, but Ugandan mid-morning tea (flavored with lemon grass, served at 10:30) is brilliant!

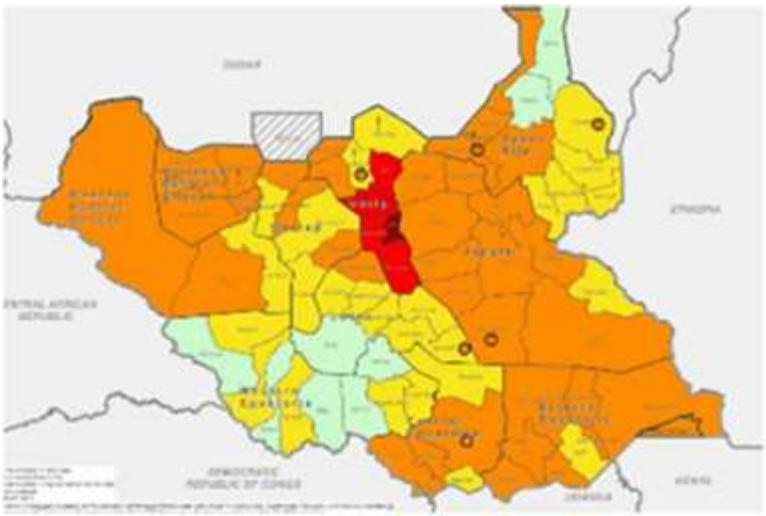
First day of the Workshop went *great*! I took John B's advice to heart, ("don't bury the lede") so I took a flyer in my session "opened with a bang". Kudos to Bill Cumming for giving me the framing device. A power outage during talk didn't slow me down (one of a half-dozen today), just went to battery mode and walked around with laptop, working the screen. Have met the Director already, having been invited to right after my program. After the team sat down, his first question to his manager Mr. Bahati was, "When am I going to see some geothermal power?" (Apparently a riff on the President of Uganda's impatience with the pace of energy development, whom he quoted, "I have not seen my first drop of oil yet." In fact, the Petroleum Exploration Division's building sits unfinished just down the hill from the Geothermal Department.) Jay Dick fielded that hot potato and earned his money today. He said that the Ugandans have to make a decision, pick a site (80% of the tech staff know what the first choice ought to be), and put that out for exploration and development.

Things went so well, that by Wednesday, on the spur of the moment I invited the entire department of Ugandan geoscientists and IT people back to my hotel for a beer blast as my guest. That turned out to be one long, raucous party. They are very bright and serious party animals! (Luckily, a dollar goes a long way.) At one point, there were six languages being spoken simultaneously at the long table (English, Swahili, Luganda, and Russian, Arabic, and Spanish, the latter three for cussing in) in at least as many subjects. Once again, I am surprised at East Africans' erudition and detailed understanding of the larger world. I wish my fellow citizens were as well-informed.**

On the short highway back to Entebbe airport Friday afternoon, the taxi followed a guy on a motorcycle with a large bundle (fascine) of fuelwood laid across the pillion seat. This in a nutshell is why Uganda (and all of east Africa) needs green energy – people need energy, so the deforestation is ferocious.

Just before our outbound flight for Addis took off, two different planes from the U.N.'s World Food Programme landed, rolled in front of the terminal, and parked. Seehttps://en.wikipedia.org/wiki/World_Food_Programme .

Ugandans are, by and large, not fat but very good-looking and seem well-nourished. See the food note above – food there was excellent -- well prepared, highly diverse, nutritious, wholesome. As good or better than the States. No G.I. problems, not even a little. So, I was puzzled, why the WFP planes? – a 4-engine jet is a helluva expensive way to move calories. Then, a big U.S. C-17 with "Travis AFB" (North Bay in the SanFran Bay Area) on the T-tail landed. (didn't get a pic of that one.) I worked on the C-17 back in the late 80s as a robotics engineer. I know this is a transport capability is unique in the world, reserved for important lift missions and force projection. I wondered, why's this precious asset here? what's the U.S. military doing in Uganda anyway? Monday morning, after I got home, the mystery was solved by the early bird TV news:



https://en.wikipedia.org/wiki/2017_South_Sudan_famine

While I was sitting in EBB airport, the U.N. was fixin' to declare a famine in South Sudan, which shares a long land border with Uganda to the south. Other than

Kenya, which has better air transit facilities in Nairobi, there are no other abutting countries the U.N./U.S. might work with (not sure about our security arrangements w/Ethiopia). So choice of possible staging areas for food aid into South Sudan is rather poor. Uganda's airport in Entebbe on the north shore of the Lake is closer to the locus of the famine by a factor of 2.

<L>~<I>~<B>~<E>~<R>~<T>~<Y>~<C>~<O>~<N>

Songs From Your Birth Date

From: "Mike Waldrip" waldripk@gmail.com

http://playback.fm/birthday-song

<L>~<I>~<B>~<E>~<R>~<T>~<Y>~<C>~<O>~<N>

Re: Passing of friends

From: "Pam Adams" pamcrippenadams@gmail.com

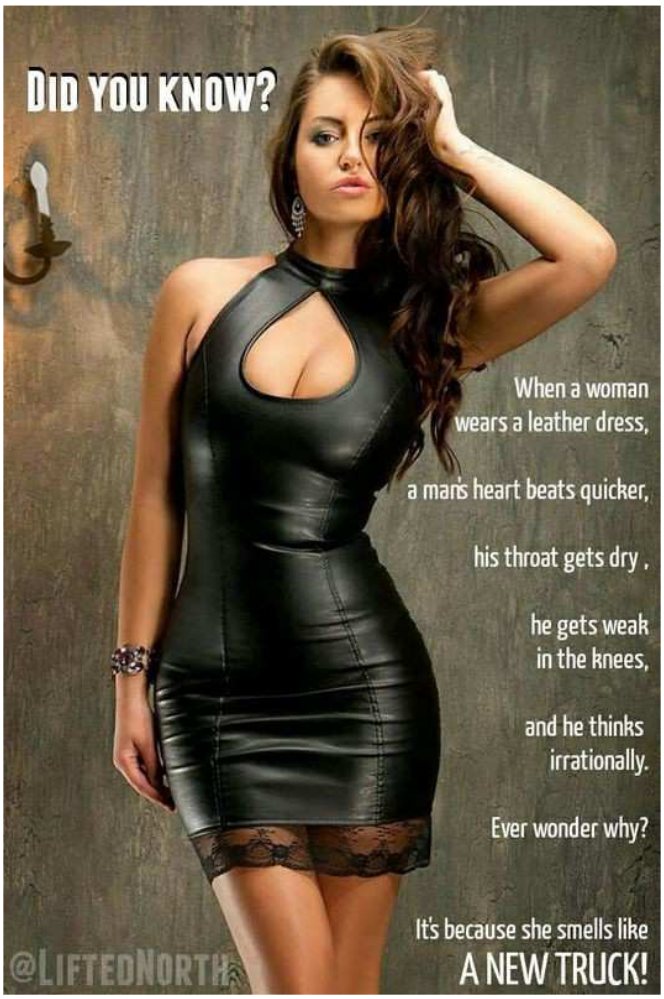
Damn, damn, damn!

Extra large hug for you!

IT'S BEEN A BITCH THE LAST FEW MONTHS. THANK YOU PAM. UT

<T>~<H>~<E>~~~<J>~<O>~<K>~<E>~<S>~~~<S>~<T>~<A>~<R>~<T>~~~<H>~<E>~<R>~<E>

From: "Mike Waldrip" waldripk@gmail.com



<J>~<O>~<K>~<E>~<S>

Mom's out of town so my dad packed my lunch

<J>~<O>~<K>~<E>~<S>

Meanwhile.....on I-85 in Atlanta....
😂😂😂😂😂😂😂

Pregnancy and Women

Pregnancy Q & A

Q: Should I have a baby after 35?
A: No, 35 children is enough.

Q: I'm two months pregnant now. When will my baby move?
A: With any luck, right after he finishes college.

Q: What is the most reliable method to determine baby's sex?
A: Childbirth.

Q: My wife is five months pregnant and so moody that sometimes she's borderline irrational.
A: So what's your question?

Q: My childbirth instructor says it's not pain I'll feel during labor, but pressure. Is she right?
A: Yes, in the same way that a tornado might be called an air current.

Q: When is the best time to get an epidural?
A: Right after you find out you're pregnant.

Q: Is there any reason I have to be in the delivery room while my wife is in labor?
A: Not unless the word 'alimony' means anything to you.

Q: Is there anything I should avoid while recovering from childbirth?
A: Yes, pregnancy.

Q: Do I have to have a baby shower?
A: Not if you change the baby's diaper very quickly.

Q: Our baby was born last week. When will my wife begin to feel and act normal again?
A: When the kids are in college.

<J>~<O>~<K>~<E>~<S>~~<of>~<the>~~<W>~<E>~<E>~<K>

From: "Jim Woosley" Jimwoosley@aol.com

Daniel Bongino
-Anti-Trump protestor ninja suit, $100.
-Anti-Trump protestor mask to hide your cowardly face, $20.
-Being chased off, all alone, screaming like a four-year-old, by an American patriot twice your age, PRICELESS!

#MakeAmericaGreatAgain

GOTCHA, I'M SORRY, BUT THIS IS FUNNY. UT

<J>~<O>~<K>~<E>~<S>~~~<of>~<the>~~~<W>~<E>~<E>~<K>

From: "Bob Bolgeo" bbolgeo@aol.com

For years you probably have wondered who first uttered the phrase

"You Gotta Be Shittin' Me".

Am I right?

Well, it just so happens to have originated through the Father of Our country, way back when George Washington was crossing the Delaware River with his troops.

There were 33 (remember this number) in Washington's boat. It was extremely dark and storming furiously and the water was tossing them about.

Finally, Washington grabbed Corporal Peters (remember this name) and stationed him at the front of the boat with a lantern. He ordered him to keep swinging it, so they could see where they were heading.

Corporal Peters, through driving rain and cold, continued swinging the lantern back and forth, back and forth.

Then a big gust of wind and a wave hit and threw Corporal Peters and his lantern into the Delaware. Washington and his troops searched for nearly an hour trying to find Corporal Peters, but to no avail. All of them felt terrible, for the Corporal had been one of their favorites.

Sometime later, Washington and his troops landed on the other side, wet and totally exhausted. He rallied the troops and told them that they must go on.

Another hour later, one of his men said, 'General, I see lights ahead.' They trudged toward the lights and came upon a huge house.

What they didn't know was that this was a house of ill repute, hidden in the forest to serve all who came.

General Washington pounded on the door, his men crowding around him.

The door swung open, and much to his surprise stood a beautiful woman.

A huge smile came across her face, to see so many men standing there.

Washington was the first to speak, 'Madam, I am General George Washington and these are my men.
We are tired, wet, exhausted, and desperately need warmth and comfort.'

Again, the Madam looked at all the men standing there, and with a broad

smile on her face, said, 'Well, General, you have come to the right place. We can surely give you warmth and comfort. How many men do you have?'

Washington replied, 'Well, Madam, there are 32 of us without Peters .'

And the Madam said, 'You gotta be shittin' me.'

I only sent this to those with a slightly warped sense of humor

<J>~<O>~<K>~<E>~<S>~~~<of>~<the>~~~<W>~<E>~<E>~<K>

From: "Ray Beloate" beerman@rittermail.com

The Geography of a Woman

Between 18 and 22, a woman is like Africa. Half discovered, half wild, fertile and naturally Beautiful!

Between 23 and 30, a woman is like Europe. Well developed and open to trade, especially for someone of real value.

Between 31 and 35, a woman is like Spain, very hot, relaxed and convinced of her own beauty.

Between 36 and 40, a woman is like Greece, gently aging but still a warm and desirable place to visit.

Between 41 and 50, a woman is like Great Britain, with a glorious and all conquering past.

Between 61 and 70, a woman is like Israel, has been through war, doesn't make the same mistakes twice, takes care of business.

Between 71 and 80, a woman is like Canada, self-preserving, but open to meeting new people.

After 80, she becomes Tibet. Wildly beautiful, with a mysterious past and the wisdom of the ages. An adventurous spirit and a thirst for spiritual knowledge.

THE GEOGRAPHY OF A MAN

Between 1 and 80, a man is like North Korea ……. ruled by a pair of nuts.

<J>~<O>~<K>~<E>~<S>

GOING TO CHURCH IN CHICAGO

When I heard Al Sharpton and Jesse Jackson were going to be guest preachers at a nearby church, I decided to go and check them out in person.

As soon as I sat down, Reverend Sharpton came over to me. I don't know why,

maybe it was because I was the only white person in the church. He laid his hands on my hand and said: "By the will of Jesus the Lord Almighty, and the will of God, you will walk today."

I told him I was not paralyzed.

Then Jesse Jackson came by and said: "By the Grace of God, and his Son Jesus, the Lord Almighty, you will walk today."

Again I said that there is nothing wrong with me.

After the sermon I stepped outside and lo and behold ---My Car Was Gone!

Amen

BOOOOOO, THAT WAS BAD. UT

<YOU>~<>~<JUST>~<>~<CAN'T>~<>~<MAKE>~<>~<THIS>~<>~<STUFF>~<>~<UP!>

YOU JUST CAN'T MAKE THIS STUFF UP!

From: "Tim Bolgeo" tbolgeo@epbfi.com

PETA: MILK IS A 'SYMBOL OF WHITE SUPREMACY'

April 1, 2017
http://www.libertyheadlines.com/peta-milk-symbol-white-supremacy/?AID=7236

(Heat Street) PETA's shenanigans vary from the absurd to the downright offensive. From likening rape survivors to pigs and cows, to calling Pokémon a form of animal cruelty, PETA's efforts to "save the animals" always make the headlines—and with good reason: they're completely absurd.

Photo by JeepersMedia (CC)

The animal rights group today released a new video to cry over milk, equating the nutritious drink with Nazism. Following the rise in Trump Derangement Syndrome and the progressive left's hysteria over white supremacism, PETA states:

"Did you know that milk has long been a symbol used by white supremacists?"

It's an alternative fact accompanied by an equally ludicrous video,

which they published on social media. They call milk the neo-Nazi drink of choice, stating that it has "long been" a symbol used by white supremacist groups as a "thinly veiled allegory for racial purity…"

I AM HOPING THIS IS JUST AN APRIL FOOLS JOKE FR0M PETA. UT

<YOU>~<>~<JUST>~<>~<CAN'T>~<>~<MAKE>~<>~<THIS>~<>~<STUFF>~<>~<UP!>

YOU JUST CAN'T MAKE THIS STUFF UP!

From: "Jim Woosley" Jimwoosley@aol.com

Received via a friend:

"HANDS" HANDLEYS LETTER TO TRUMP

This guy was a contemporary of mine back in the day. I didn't know him, he was stationed a Ubon and I was at Takhli. (both in Thailand)

He is credited with the only gun kill of a Mig-19. Lucky bastard had the first internal gun equipped Rhino model F4E. I only flew Cs and Ds missile equipped or I should say handicapped.

http://www.nickelonthegrass.net/F-35letter.pdf

WHN I WAS A CHILD, I WAS AN AUTOMATIC FLIGHT CONTROLS SYSTEM SPECIALIST (AUTOPILOTS) STATIONED AT KORAT ROYAL THAI AIRFORCE BASE IN 1969 WORKING ON F-105G'S AND F-4E'S. THAT'S WHY I LIKE THIS GUY. UT

<YOU>~<>~<JUST>~<>~<CAN'T>~<>~<MAKE>~<>~<THIS>~<>~<STUFF>~<>~<UP!>

SOME FAMILY OF SNOWFLAKES NEED A LONG TIME OUT IN ANOTHER COUNTRY. SOMEPLACE LIKE SYRIA OR IRAQ OR IRAN. UT

<S>~<C>~<I>~<E>~<N>~<C>~<E>~~~<S>~<T>~<A>~<R>~<T>~<S>~~~<H>~<E>~<R>~<E>

From: "Tim Bolgeo" tbolgeo@epbfi.com

DID THE AIR FORCE DASH HOPES FOR BUILDING MORE F-22S?

Military.com | 26 Mar 2017 | by Oriana Pawlyk
http://www.military.com/daily-news/2017/03/26/did-the-air-force-dash-its-hopes-for-building-more-f-22s.html?ESRC=airforce_170328.nl

An F-22 Raptor is towed to its hangar on Feb. 27 at Tyndall Air Force Base, Fla. (Military.com photo/Oriana Pawlyk)

When the F-22 Raptor production line ceased in 2011, Air Force Lt. Col. Daniel thought the Pentagon had made a huge mistake.

He was driving in his car in 2009 when he found out "the Raptor fleet is done at 187, and I remember thinking, 'This is not great.' I thought it was an error."

Because, "more is better than less, right?" said the F-22 pilot of the 95th Fighter Squadron. He spoke to Military.com on the condition that his last name not be used, due to safety concerns amid ongoing air operations against the Islamic State.

Military.com recently sat down with a few pilots and a maintainer at Tyndall Air Force Base in Florida, as part of a trip to observe fifth-generation F-22s flying with fourth-generation F/A-18 Hornets for training.

The Air Force originally wanted at least 381 Raptors. Had the service acquired that many of the stealthy twin-engine fighters from Lockheed Martin Corp., life nowadays might be somewhat less hectic for the service members who fly and maintain them.

More of the F-22 fleet could "mitigate [operations] tempo, and we're always on the road so if we had more Raptors, there'd be more Raptor squadrons, more Raptor maintainers that would mitigate some training and operational demands," Daniel said.

Lt. Col. Ben of the 325th Operations Group agreed.

"That's exactly right," he said. "But these decisions are above my pay grade."
Daniel added, "Of course, there's a huge cost with that."

He's right. Indeed, cost was the driving factor behind then-Defense Secretary Bob Gates' decision to push for the Pentagon to prematurely stop buying the aircraft.

$20 BILLION RESTART

According to a 2010 RAND study, to restart the F-22 production line to build 75 more of the jets would cost about $20 billion in inflation-adjusted dollars.

To build a new Raptor -- not a 1990s version -- "you're not building the same airplane you were building before, and it becomes a much more expensive proposition," a defense analyst in Washington, D.C. told Military.com on background on Thursday.

"So do you build a new 'old' F-22, or do you build an improved one?" the analyst said.

And that figure is a rough estimate to restart a marginal lot of planes. It doesn't take into account the cost of hiring workers, integrating newer stealth technologies, or training and equipping additional pilots.

Preparing Raptor pilots to fly from the nest takes time, too.

"To make a really good F-22 pilot, I need about seven to eight years to get him to where he is fully employing a jet and can actually quarterback the whole fight," Daniel said.

But as the Air Force weighs retiring its F-15C/D fleet sometime in the mid-2020s (though lawmakers in Congress will have a say in the matter), many defense experts question how the service plans to maintain its air superiority. For example, will the F-22 eventually take over the role of the F-15 Eagle? If so, will Raptor pilots be more in demand than ever?

F-16S INSTEAD OF F-22S?

The questions aren't abstract. Both the active-duty component and Air National Guard are considering retiring the Boeing-made Eagle, service officials told the House Armed Services Subcommittee during a hearing on Wednesday. The F-16 Fighting Falcon could take over missions from the F-15, they said.

Rep. Martha McSally, an Arizona Republican and former Air Force officer who flew the A-10 Thunderbolt II ground-attack aircraft, said "prior to the F-22, [the F-15] was the best at air-to-air." The F-16, a fixed-wing, single-engine, fourth-generation platform, "doesn't bring the same capability," she said.

The reference by Air Force officials to F-16 rather than F-22 during the hearing also caught the analyst by surprise.

"Why didn't the Air Force say F-22 restart?" he said during a telephone interview. "Why did they leak that they're looking to replace it with F-16s instead of using it as a case to examine F-22 restart?"

One reason might be because the Senate hasn't yet confirmed Heather Wilson, a former Congresswoman nominated by President Donald Trump, to become the next Air Force Secretary, the analyst said. Until she's confirmed, "the Air Force is worried about making any major decisions," he said.

Another reason might be because Air Force leaders have zero interest in restarting the F-22 production line. The reference to F-16 may suggest "this is the end for F-22 restart story -- not the beginning of it," he said.

UPGRADES COMING

Earlier this week, officials at Lockheed -- which produces the F-16 and F-22 -- told DefenseOne it plans to move the F-16 production line to South Carolina from Fort Worth, Texas, where it built the single-engine fighters for more than 40 years.

As of Sept. 30, the Air Force had 949 Fighting Falcons, according to Air Force inventory figures obtained by Military.com.

By comparison, the service has less than half as many Eagles and F-15E Strike Eagles. The F-15 inventory totals 456 aircraft and is split almost evenly between the two variants, with 236 of the older Eagles, including 212 one-seat F-15C models and 24 two-seat F-16D models, according to the service data.

"F-15C/D is just one job," the analyst said of the all-weather, tactical fighter. "The Air Force is going to make the same argument it made on the A-10, which is, 'As we look around the Air Force to save money, we're going to retire things that have one job.'

"The F-16 is multi-role … and the F-16 has grown significantly since it was just a little squirt under the F-15's wing," he said.

For example, in December, Raytheon Co. was awarded a contract to upgrade the F-16 computer system as part of the Modular Mission Computer Upgrade, which features "more than two times the current processing power and 40 times the current memory, equipping USAF pilots with near-fifth-generation aircraft computing power," the company said in a release at the time.

Just this past week, the Air Force announced the 416th Flight Test Squadron at Edwards Air Force Base in California has begun testing F-16s equipped with Northrop Grumman's

APG-83 Scalable Agile Beam Radar, a fifth-generation Active Electronically Scanned Array fire-control radar.

"It is intended to replace currently used APG-66 and APG-68 radars and provide the F-16 with advanced capabilities similar to fifth-generation fighters like the F-22 Raptor and F-35 Lightning II," the service said in a release.

The Air Force claims it has the capacity in the F-16C community "to recapitalize … radar to serve the same function as the F-15 has done and thereby reduce the different systems that we have to sustain and operate, so that makes it more efficient," said Maj. Gen. Scott D. West, director of current operations and the service's deputy chief of staff for operations at the Pentagon.

The effort will help minimize the number of systems pilots operate, West said during the hearing on Capitol Hill.

As for the Eagle, Air National Guard Director Lt. Gen. Scott Rice told Military.com that any planned upgrades will be fulfilled. However, the Air Force may want to look at the next block of upgrades to save on future sustainment and operational costs, he said.

Rice said he believes the Air Force is getting beyond comparing aircraft platforms, "especially in the digital age" when looking at the platforms as systems and "how they integrate is as important and, in the future, will be even more important than the platform itself," he said.

The F-16 is a "less capable dogfighter than the F-15," the analyst added, "but at the same time the question is, 'How realistic is it that you're going to have a single F-16 without any help'" from other fighter jets? "That's not how we plan to fly," he said.

A MAGICAL AIRFRAME?

Last year, the House Armed Services Air and Land Forces subcommittee tasked the Air Force to issue a study of what it would take to get the F-22 line up and running again.

Whether the official study has been completed, "preliminary assessment showed it was cost prohibitive to reopen the F-22 line," an Air Force spokeswoman told Military.com on Thursday, in line with RAND's study.

Even so, Lockheed is offering advice on what it would take to do so, said John Cottam, F-22 program deputy for the company in Fort Worth.

"They have come to us and have asked us for inputs into that study, so we have been working very hard with them, in concert with them to provide that data," he said last month. "With this new administration, they have priorities that are putting Americans back to work and making America strong, so we believe that what the Air Force provides could very easily resonate with the administration's policies."

Cottam added, "As time goes on, if the report isn't delivered [to Congress], we can then keep delivering our responses and making it more and more refined."
Meanwhile, Raptor pilots can't help but wonder if newly minted aircraft will again come off the production line.

In any exercise, pilots show up the first couple of days, "integrate with other platforms -- everyone's trying to learn," Daniel said. "By the end of the first week, everybody realized we need about 30 more F-22s in the lane because as soon as the F-22s leave, people start to die in the air-to-air fight."

Daniel said, "It's always disappointing that we don't have more, or don't have more missiles, more gas -- it's always frustrating as an F-22 pilot when you hear, 'Bingo, bingo,' and you're out of missiles and you go home and you start hearing other planes getting shot down."

The stealth, the speed, the "unfair amount of information the jet provides to us … .it's magic," he said.

Even with oncoming upgrades to the F-16, many fighter pilots and others question whether a fourth-generation fighter will -- or could -- ever step up to such a role.

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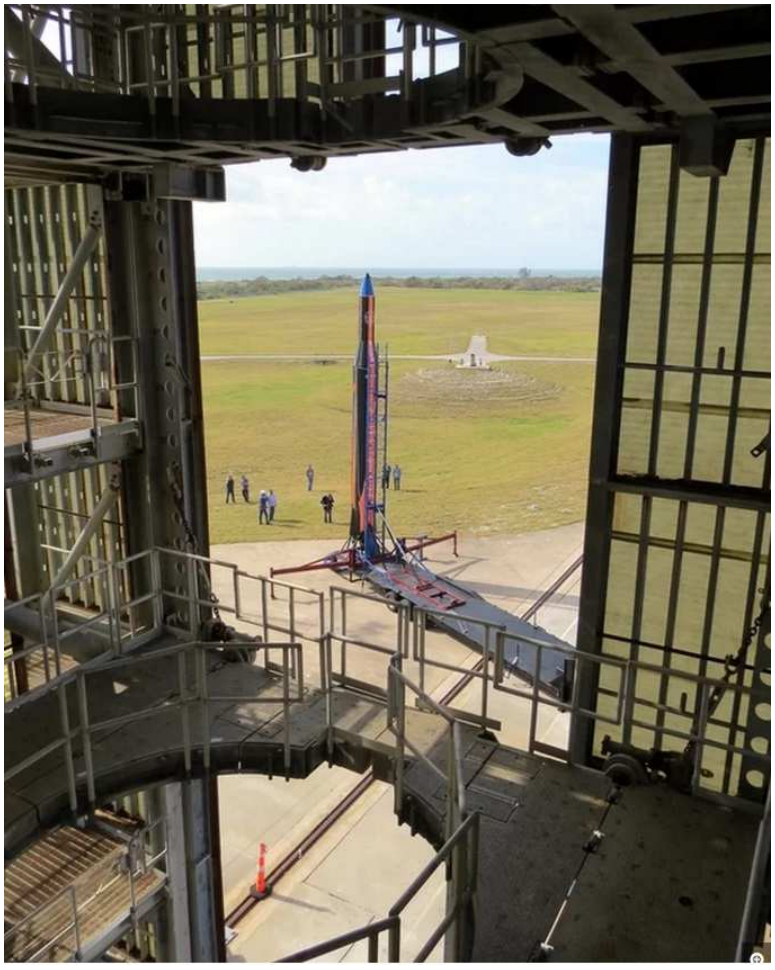
VECTOR SPACE SYSTEMS WILL LAUNCH MICROSATELLITE ROCKETS FROM FLORIDA

By Irene Klotz, Space.com Contributor | March 27, 2017 07:30pm ET
http://www.space.com/36237-vector-space-microsatellite-rockets-florida-launches.html



A Vector Space Systems rocket at Launch Complex 46 of the Cape Canaveral Air Force Station in Florida. Credit: Vector Space Systems

CAPE CANAVERAL, Fla. — Eyeing a projected boom in demand for microsatellites, startup Vector Space Systems on Saturday (March 25) unveiled plans to fly its small launch vehicle from a Florida-owned launch pad at Cape Canaveral Air Force Station.

"We need precisely what that one has," Vector co-founder and chief executive Jim Cantrell told Space.com.

Which, in terms of infrastructure, is not much. In the late 1990s, Space Florida, a state-backed economic development agency, took over Launch Complex 46 (LC 46) from the Air Force with plans to turn it into a multiuser pad for

small launch vehicles. [Images: Vector Space's Microsatellite-Launching Rocket]

Orbital ATK has a mission booked at LC 46 for later this year for its Minotaur IV rocket. In 1998 and 1999, Lockheed Martin flew two Athena boosters from the pad. The U.S. Navy originally used the pad in the 1980s to test Trident II missiles.

With its mobile launcher system, Vector Space aims to use LC 46 beginning in 2018 for its small-satellite rockets, known as Vector-R (Rapide) and Vector-H (Heavy).

The 45-foot-tall (14 meters), two-stage Vector-R is designed to carry payloads of up to about 140 lbs. (64 kilograms) into low-Earth orbit at a cost of about $1.5 million. That's less than half the price of Rocket Lab's larger Electron rocket, which is being prepared for its debut test flight from New Zealand in the next few weeks.

An optional third-stage electric motor on a Vector-R can deliver a satellite up to 500 miles (800 kilometers) above Earth for an additional $500,000. The larger Vector-H version sells for about $3 million.

The rockets are simple, with no pumps and far fewer components than current boosters have. The Vector's first stage, for example, has just 15 parts, Cantrell said.

For propellants, the rockets use propylene and liquid oxygen. The propylene is compressed to a liquid and chilled to make it about as dense as kerosene. "You have a small rocket with a lot more energy," Cantrell said, adding that the burning propylene creates a distinctive, bright-orange flame.

Suborbital test flights are scheduled to begin next month from the Friends of Amateur Rocketry's (FAR) launch site near California's Mojave Desert.

So far, Vector Space, based in Tucson, Arizona, has contracts for 105 flights. Customers include Finland's Iceye, which is developing a satellite constellation to provide near-real-time global radar imagery; Denver-based small-satellite manufacturer York Space Systems; and Bethesda, Maryland-based PlanetiQ, which is developing a commercial weather-satellite network.

Vector Space also has an agreement to fly from Alaska's Kodiak Island and other locations, including outside the United States.

The company has raised about $4 million in seed funds and won DARPA and NASA contracts for about another $4.5 million. It is in the process of a Series A investment round, with the aim of raising $15 million, Cantrell said.

Vector Space, founded and run by veterans from SpaceX, Virgin Galactic and other aerospace companies, has an ultimate goal of opening space access to anyone — no satellite required. Instead of buying and operating satellites, the company envisions customers using software applications to get what they want via a cloud of satellites. The project is known as Galactic Sky.

"To me, this is the PC of space," Cantrell said. "It is going to upend the industry in a way people just don't understand."

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"SAMSUNG DEX" IS A GALAXY S8 DOCK THAT MAKES YOUR PHONE INTO A DESKTOP

Another product blurs the lines between phone and desktop.

ANDREW CUNNINGHAM - 3/29/2017, 12:42 PM
https://arstechnica.com/gadgets/2017/03/samsung-dex-is-a-galaxy-s8-dock-that-makes-your-phone-into-a-desktop/

Samsung's Dex makes the Galaxy S8 into a fake desktop.

Samsung brought a few different accessories to the launch party for the Galaxy S8 this morning. One, Samsung Dex, is the latest in a long line of products that promise to let you replace your desktop computer with your phone.

Samsung hasn't announced pricing or a release date, and most of what we know comes from Samsung's presentation. The dock is small and circular, includes two USB ports and an HDMI port, and it is powered via USB-C (same as the S8 itself). The Verge reports that there's a small cooling fan inside the dock that presumably keeps the phone from throttling too much, enabling more desktop-y performance.

The desktop UI looks mostly straightforward: there's a lock screen, a desktop, and a Windows or Chrome OS-esque taskbar with app icons on it. You can use apps full-screen or keep them in windows—we're still talking about Android apps, and not all of them are well-suited to running on anything other than a phone or a small, narrow window.

Dex is one of several products that is blurring the lines between phones and desktops. Remix OS is an Android distribution that you can install directly on regular PCs, Google has experimented with its own windowed multitasking mode in some Android N betas, and supporting Android apps in Chrome OS accomplishes much the same thing. And while Microsoft's Windows Phone is effectively dead, using a Windows 10 handset with a compatible dock can similarly expand a phone UI and apps to simulate a desktop experience. And way back in the day, the also-doomed Ubuntu Phone also used the promise of desktop convergence to differentiate it from then-mobile-only operating systems like iOS and Android.

Listing image by Samsung

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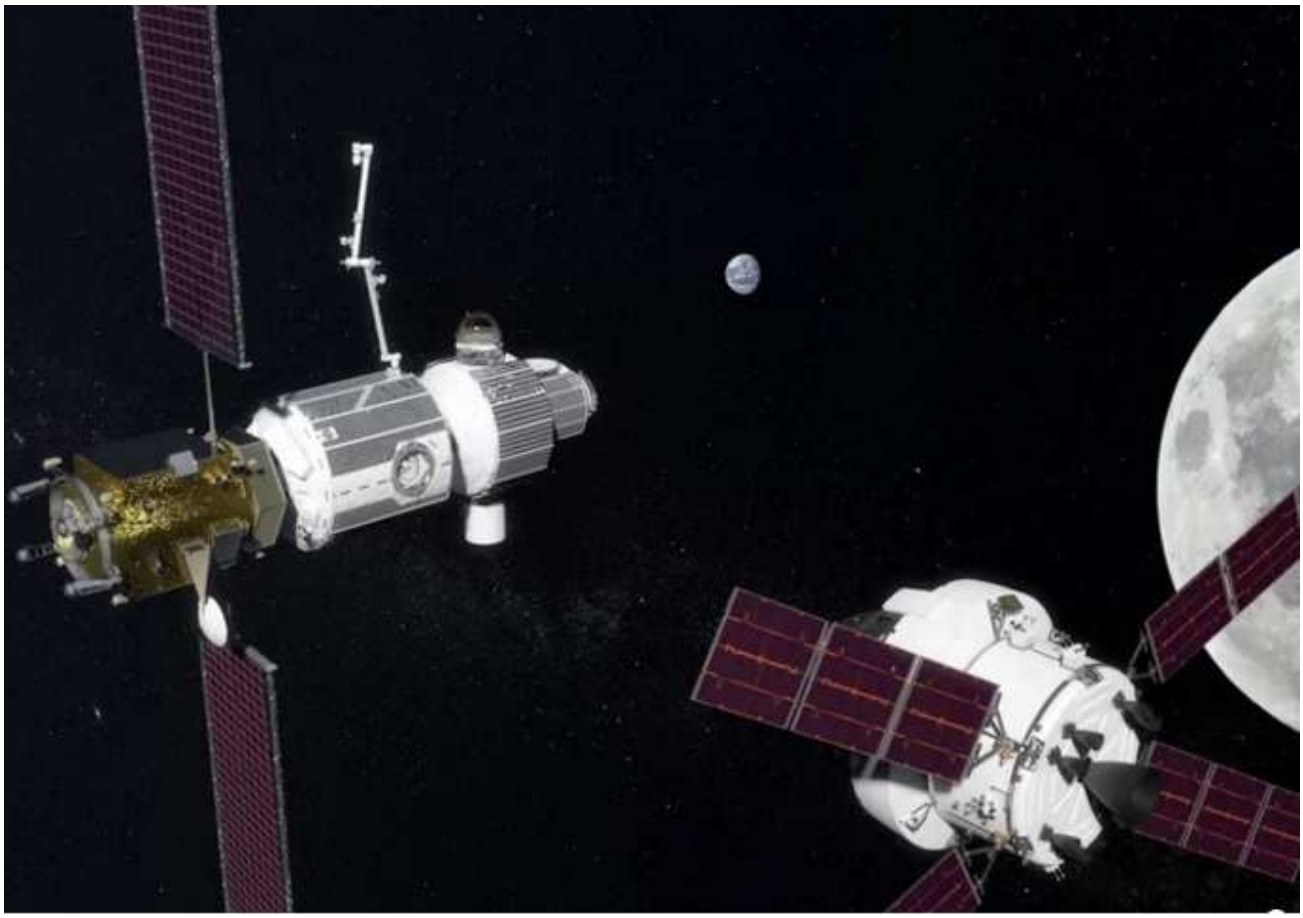
NASA EYEING MINI SPACE STATION IN LUNAR ORBIT AS STEPPING-STONE TO MARS

By Mike Wall, Space.com Senior Writer | March 30, 2017 06:30am ET
http://www.space.com/36270-nasa-deep-space-gateway-moon-orbit.html

It looks like NASA's stepping-stone to Mars will be a miniature space station in lunar orbit rather than a chunk of captured asteroid.



Artist's concept of NASA's "deep space gateway" in lunar orbit. This astronaut-tended outpost would serve as a stepping stone for crewed trips to Mars. Credit: NASA

The agency plans to build an astronaut-tended "deep space gateway" in orbit around the moon during the first few missions of the Space Launch System (SLS) megarocket and Orion crew capsule, which are scheduled to fly together for the first time in late 2018, NASA officials said.

"I envision different partners, both international and commercial, contributing to the gateway and using it in a variety of ways with a system that can move to different orbits to enable a variety of missions," William Gerstenmaier, associate administrator for Human Exploration and Operations at NASA headquarters in Washington, D.C, said in a statement.

The gateway could move to support robotic or partner missions to the surface of the moon, or to a high lunar orbit to support missions departing from the gateway to other destinations in the solar system," Gerstenmaier added.

One of those "other destinations" is Mars. NASA is working to get astronauts to the vicinity of the Red Planet sometime in the 2030s, as directed by former President Barack Obama in 2010. For the last few years, the agency's envisioned "Journey to Mars" campaign has included the Asteroid Redirect Mission (ARM), an effort to pluck a boulder from a near-Earth asteroid and drag the rock to lunar orbit, where it could be visited by astronauts aboard Orion.

But ARM's future looks bleak; President Donald Trump provided no money for the mission in his proposed 2018 federal budget, which the White House released earlier this month.

There's no mention of ARM in NASA's newly unveiled "gateway" plan, which outlines the basic architecture of a small, sometimes-staffed space station in lunar orbit.

"This deep space gateway would have a power bus, a small habitat to extend crew time, docking capability, an airlock, and [would be] serviced by logistics modules to enable research," NASA officials wrote in the same statement. "The propulsion system on the gateway mainly uses high-power electric propulsion for station-keeping and the ability to transfer among a family of orbits in the lunar vicinity."

Construction and initial use of the gateway would constitute phase one of NASA's crewed efforts in the vicinity of the moon, agency officials said. Phase two involves the completion of a reusable "deep-space transport spacecraft."

"This spacecraft would be a reusable vehicle that uses electric and chemical propulsion and would be specifically designed for crewed missions to destinations such as Mars," agency officials said. "The transport would take crew out to their destination [and] return them back to the gateway, where it can be serviced and sent out again."

If everything goes according to (the new) plan, phase two will wrap up at the end of the 2020s with a one-year mission near the moon, which will validate the ability of the gateway-transport system to operate for extended periods in deep space.

As currently envisioned, the first SLS-Orion flight — known as Exploration Mission 1 (EM-1) — will be an uncrewed journey that makes its way to lunar orbit. However, NASA is considering putting astronauts aboard the flight — a change that would likely delay the mission by at least a year.

The second mission, EM-2, is currently slated to send astronauts around the moon. It could launch as early as 2021. After EM-2, NASA aims to begin launching SLS-Orion missions once every year, NASA officials said.

The Orion capsule already has one space mission under its belt. In December 2014, the spacecraft launched atop a United Launch Alliance Delta IV Heavy rocket on an uncrewed test flight to Earth orbit.

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USED SPACEX ROCKET LAUNCHES SATELLITE, THEN LANDS IN HISTORIC 1ST REFLIGHT

By Irene Klotz, Space.com Contributor | March 30, 2017 06:51pm ET
http://www.space.com/36291-spacex-used-rocket-launch-landing-success.html

VIDEO OF THE FLIGHT IS AVAILABLE AT THE WEBSITE.

CAPE CANAVERAL, Fla. — A SpaceX Falcon 9 rocket soared off a seaside launch pad at NASA's Kennedy Space Center here today (March 30) on an unprecedented second mission to deliver a spacecraft into orbit, proving the booster's reusability.

The two-stage, 23-story-tall rocket lifted off at 6:27 p.m. EDT (2227 GMT) in the second launch in two weeks for Elon Musk's SpaceX, which is ramping up its flight rate following an accident in September.

Perched on top of the rocket, which sported a new upper stage and payload fairing, was the 11,645-lb. (5,282 kilograms) SES-10 communications satellite, which is intended to provide TV, internet and other services to customers in Latin America. [In Photos: SpaceX Launches, Lands 1st Reused Falcon 9 Rocket]

"This is a really, really exciting step forward," Martin Halliwell, chief technology officer of Luxembourg-based SES, said before launch. "I think the whole industry is looking."

The rocket's first stage previously lifted off in April 2016, sending SpaceX's robotic Dragon cargo ship on its way to the International Space Station for NASA. The booster then landed on one of SpaceX's robotic "drone ships" in the ocean and was refurbished for reflight, a key component of Musk's goal to cut launch costs.

The Falcon 9 first stage aced its landing again tonight, settling softly onto the deck of the drone ship "Of Course I Still Love You."

"It's an amazing day for … the space industry," Musk said shortly after the rocket touched down. "It means you can fly and refly an orbit-class booster, which is the most expensive part of the rocket. This is going to be ultimately a huge revolution in spaceflight."

SpaceX also successfully recovered the Falcon 9's payload fairing — the nose cone that protected SES-10 during liftoff — Musk revealed during a post-launch teleconference with reporters. The $6 million fairing achieved its own soft landing in the Atlantic Ocean using an onboard thruster system and a parachute, Musk said.

"That was definitely the cherry on the cake," he said, adding that SpaceX intends to re-fly payload fairings just as it does Falcon 9 first stages.

SpaceX has now launched and landed Falcon 9 first stages nine different times. Six of these touchdowns have occurred on drone ships, and three have taken place on terra firma at Cape Canaveral. (SpaceX would ideally like to bring all its boosters back on land, Musk has said, but some missions use so much fuel on the ascent phase that ocean touchdowns are necessary.)

VIDEO OF THE TOUCHDOWN OF THE SPACEX DRONE IS AVAILABLE AT THE WEBSITE.

Today's launch continues what is expected to be a busy year for both SpaceX, which is aiming to fly about every two to three weeks, and for SES, which has nine more satellites awaiting rides into orbit. Three of those trips will employ Falcon 9 rockets, and the company is open to using previously flown boosters again, Halliwell said.

SES-10 was to be delivered into an initial elliptical orbit ranging from 135 miles (218 kilometers) to 22,002 miles (35,410 km) above the planet and inclined about 26.2 degrees relative to the equator.

Over the next month or so, the satellite will maneuver itself until it reaches its intended operational circular orbit some 22,300 miles (35,800 km) above the equator and in a relatively fixed position at 67 degrees west longitude, SES representatives have said.

Today's launch was SpaceX's third from Kennedy Space Center's Launch Complex 39A, which hosted most of the Apollo moon mission and space shuttle liftoffs. In 2014, SpaceX signed a 20-year lease to use the pad.

SpaceX is not the first company to launch a booster to space multiple times. Blue Origin, which is run by Amazon.com founder Jeff Bezos, launched and landed the same New Shepard rocket five times between November 2015 and October 2016. But all of those New Shepard missions were test flights to suborbital, not orbital, space.

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VIDEO: HUGE REVOLUTION IN SPACEFLIGHT' - ELON MUSK

http://www.space.com/36293-huge-revolution-in-spaceflight-elon-musk-comments-on-1st-reused-spacex-rocket-video.html?utm_source=sp-newsletter&utm_medium=email&utm_campaign=20170331-sdc

ELON MUCK DESERVES A NOBEL PRIZE FOR ALL OF HIS CONTRIBUTIONS TO SPACE FLIGHT. UT

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RUSSIA DEVELOPS HYPERSONIC 4,600 MPH ZIRCON MISSILE

FoxNews.com, Published April 01, 2017
http://www.foxnews.com/tech/2017/04/01/russia-develops-hypersonic-4600-mph-zircon-missile.html

The race to develop an unstoppable and unbeatable weapon capable of defeating all the military defense systems in the world is getting much too close for comfort.

According to multiple reports, Russia is expected to begin production soon of its 3M22 Zircon, a hypersonic missile that will travel 4,600 miles per hour — five times the speed of sound — and will have a range of 250 miles. That's just three minutes and 15 seconds from launch to impact.

Guided hypersonic missiles will be more accurate than traditional ballistic missiles and could conceivably be armed with nuclear warheads, according to the geopolitical analysis firm Stratfor.

And they're coming, whether we like it or not. And they'll be on our doorstep sooner, not later.

"State tests of Zircon are scheduled for completion in 2017 … and the missile's serial production is planned to be launched next year," the Russian news agency TASS reported last year, quoting sources. And last month, Russia's Interfax news agency cited a source

familiar with the Zircon project who said the 5-ton missile is likely to be tested for the first time this spring — earlier than the projected date of 2018 — "from a sea-based platform."

File photo - Russian warships sail past exploding anti-missile ordnance during a rehearsal for the Navy Day parade in the far eastern port of Vladivostok, Russia, July 30, 2016. (REUTERS/Yuri Maltsev)

The International Business Times (IBT) reported that the U.S. Navy is concerned the missile could be fitted to a Russian warship.

Hypersonic speed is the stuff of science fiction. As explained in IBT:
"The missile employs revolutionary scramjet technology to reach its hypersonic speeds whereby propulsion is created by forcing air from the atmosphere into its combustor where it mixes with on-board fuel – rather than carry both fuel and oxidizer like traditional rockets. This makes it lighter, and therefore much faster.

"It uses no fans, rotating turbines or moving parts – just an inlet where air is compressed and a combustor where the air is mixed with fuel. Fewer moving parts also means less chance of mechanical failure.

"The Zircon … would be capable of destroying the world's most advanced warships and aircraft carriers in one strike and could be put into action by 2020."
The Zircon will have a radar target seeker and an optical-electronic complex that can trace and detect targets, also at hypersonic speed, according to the Strategic Culture Foundation.

"It will greatly reduce the reaction time that [Western military units] have to deploy their own defenses and counter-measures," Tim Ripley, who covers defense issues for Jane's Defence Weekly, told the German international broadcaster Deutsche Welle.

He said the Zircon could render Western anti-aircraft defenses "obsolete," and he warned that Russia appears far ahead of the U.S. in development.

"In the public domain, the West seems to be quite a long way behind," Ripley said. "But that doesn't mean there isn't some black, super-secret project run by the U.S.' Defense Advanced Research Projects Agency, or DARPA."

In fact, the U.S. may not be behind at all. According to Stratfor, U.S. Maj. Gen. Thomas Masiello announced in late February that the Air Force plans to have operational prototypes of its own hypersonic missile ready for testing by 2020.

And Stratfor forecasts that the U.S. and China will likely have the first operational long-range hypersonic missiles in their arsenals by 2025, years ahead of Russia.

India is also working to develop a hypersonic missile. According to India Today, India is developing its BrahMos II missile in collaboration with Russia, and it will use the same scramjet technology as Zircon.

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ISRAEL'S ARROW ANTI-MISSILE SYSTEM SCORES FIRST HIT

FoxNews.com, Published March 17, 2017
http://www.foxnews.com/tech/2017/03/17/israels-arrow-anti-missile-system-scores-first-hit.html

File photo - An "Arrow 3" ballistic missile interceptor is seen during its test launch near Ashdod December 10, 2015. (REUTERS/Amir Cohen)

Israel's sophisticated Arrow anti-missile system has scored its first hit, taking down a surface-to-air missile fired from Syria, according to media reports.

The Jerusalem Post reports that the Arrow interceptor was used for the first time after Israeli fighter jets were targeted with Syrian anti-aircraft missiles during an operation over Syria.
Newspaper Haaretz said the interception took place north of Jerusalem. Israeli Channel 10 TV reports the Israeli military had been on a mission to destroy a weapons convoy destined for the Lebanese Hezbollah group, which is backed by Iran and fights alongside Syrian government forces.

Arrow provides the top layer of the country's complex aerial defense system. Whereas the country's Iron Dome system deals with short-range threats such as rockets, and David's Sling is designed to tackle midrange threats, Arrow can take out targets outside Earth's atmosphere.

Earlier this year the Israel Air Force took delivery of the state-of-the-art Arrow-3 system, which is developed by Israel Aircraft Industries (IAI) in conjunction with Boeing. Arrow-3's first test flight was in 2013, with its final test flight in 2015.

Each Arrow-3 rocket is estimated to cost about $2.2 million, according to Haaretz. The project is co-managed by Israel's Missile Defense Organization and the U.S. Missile Defense Agency.

The Israeli military said its aircraft struck several targets in Syria and were back in Israeli-controlled airspace when several anti-aircraft missiles were launched from Syria toward the Israeli jets.

Israeli aerial defense systems intercepted one of the missiles, the army said, without elaborating.

Designed to eliminate ballistic missiles high in the stratosphere, it is not clear why the Arrow system was used in the incident, according to reports.

The firing of missiles from Syria toward Israeli aircraft is extremely rare, though Israeli military officials reported a shoulder-fired missile a few months ago.

A Syrian military statement said four Israeli warplanes violated Syrian airspace — flying into Syria through Lebanese territory — and targeted a military position in central Syria.

Damascus said Syrian anti-aircraft systems confronted the planes and claimed one of the jets was shot down in Israeli- controlled territory and that another was hit. The Israeli military denied the allegation and there was no sign that any of the jets had been hit or downed.

The Arrow system has been used in Israel since the 1990s, according to the Jerusalem Post.

The Associated Press contributed to this report.

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US ARMY SET FOR NEW LIGHTWEIGHT COMBAT HELMET

FoxNews.com, Published March 28, 2017
http://www.foxnews.com/tech/2017/03/28/us-army-set-for-new-lightweight-combat-helmet.html

(U.S. Army)

The U.S. Army is planning to deploy a combat helmet that is 22 percent lighter than the current helmet used by soldiers.

Announced on Monday, the Advanced Combat Helmet (ACH) Generation II is said to weigh less and provide the same amount of protection, according to the Army.

The helmet uses ultra-high-molecular-weight polyethylene, which is a lighter material than Kevlar. In addition, the Army says that the new helmet can stop rounds from a 9mm handgun as well as shell fragments.

A contract for up to $98 million to develop the helmets over the next five years was awarded to Revision Military, located in Vermont.

"With a renewed focus on research and development, our goal is a revolutionary leap in technology for personal protective equipment in the future, said Lt. Col. Kathy M. Brown, product manager for soldier protective equipment, in a press release.

While the helmet's weight depends upon its size, the Army said a large helmet will weigh under 2.5 pounds, roughly 12 ounces less than the current ACH in use.

The helmet is part of an Army initiative to modernize its equipment and lighten the loads for soldiers and vehicles in combat. One finished product, slated to be fielded in 2020, will involve an integrated head protection system consisting of a helmet, visor, mandible for the lower jaw and a "ballistic applique" that is attached over the helmet, according to the Army.

The Army is also developing body armor that fits its smaller soldiers and women better, and exploring lighter next-generation tanks.

Brig. Gen. Robert L. Marion, deputy of acquisition and systems management for the Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology, noted that the new body armor has, "The same level or greater protection for up to 26 percent less weight."

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ELON MUSK: SPACEX MAY AIM FOR COMPLETELY REUSABLE FALCON 9 ROCKET

By Mike Wall, Space.com Senior Writer | March 30, 2017 11:16pm ET
http://www.space.com/36296-spacex-completely-reusable-falcon-9-rocket.html

SpaceX's reusable-rocket ambitions are apparently even grander than we thought.
The company lofted the SES-10 communications satellite to orbit Thursday (March 30) using a Falcon 9 booster whose first stage already had a space mission under its belt — a historic milestone in SpaceX founder and CEO Elon Musk's quest to slash the cost of spaceflight through the use of reusable hardware.

The two-stage Falcon 9's first stage landed successfully, for the second time, about 9 minutes after liftoff Thursday. But that's not the only piece of the rocket that SpaceX recovered.

The first stage of a SpaceX Falcon 9 rocket sits on the deck of a robotic "drone ship"

shortly after landing on March 30, 2017. The touchdown was the second for the booster, which also touched down after a mission in April 2016. Credit: SpaceX

During a post-launch teleconference with reporters Thursday evening, Musk revealed that the Falcon 9's payload fairing — the protective nose cone that shielded SES-10 during launch — came back for a soft splashdown in the Atlantic Ocean, thanks to onboard thrusters and a steerable parachute.

"That was definitely the cherry on the cake," Musk said.

That cherry is pretty valuable: It cost about $6 million to build the 16.5-foot-wide (5 meters) fairing, Musk said. (For perspective, SpaceX currently sells Falcon 9 launches for $62 million each.)

"That's looking quite promising," he said of the fairing's return-to-Earth technology. "So what we'll have is kind of like a bouncy castle for it to land on, and aim to reuse the fairing as well."

And that may not be all.

"We didn't originally intend for Falcon 9 to have a reusable upper stage, but it might be fun to try like a Hail Mary," Musk said. "What's the worst that could happen — it blows up? It blows up anyway."

But even if that Hail Mary pass doesn't work, the price of a Falcon 9 launch should still come down considerably in the near future, Musk said.

"Assuming the fairing reuse works out, and as we optimize the cost of the reuse of the booster, you're really looking at maybe three-quarters of the rocket costs dropping by an order of magnitude, and maybe more," he said.

SpaceX's reusability vision extends beyond the Falcon 9, all the way out to launch systems the company aims to develop for Mars colonization.

"Rapid and complete reusability of rockets is really the key to opening up space and becoming a spacefaring civilization, a multiplanet species, and having the future be something that's incredibly exciting and inspiring that we'll all look forward to," Musk said.

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FIRST SPACEX RE-FLOWN ROCKET STAGE TO BE GIFT TO THE CAPE, SAYS ELON MUSK

By Robert Z. Pearlman, collectSPACE.com Editor | March 31, 2017 10:47am ET
http://www.space.com/36305-spacex-reflown-stage-gift-to-cape.html?utm_source=sp-newsletter&utm_medium=email&utm_campaign=20170403-sdc

A SpaceX Falcon 9 rocket, including a flight-proven first stage, lifts off with the SES-10 communications satellite from NASA's Launch Pad 39A at the Kennedy Space Center on March 30, 2017. Credit: SpaceX

SpaceX's first "flight-proven" booster to be launched and recovered for a second time will not leave Florida's coast again, on another spaceflight or otherwise.
The reused Falcon 9 rocket first stage, which made history touching down on an ocean-based drone ship just minutes after lifting off with the SES-10 communications satellite on Thursday (March 30), won't fly again but instead be retired and put on display near its launch site.

"We think this one has some historic value," said SpaceX's CEO Elon Musk in a post-launch press conference, "so we are thinking the Cape might like to have it as something to remember the moment. We are going to present it as a gift to the Cape." [In Photos: SpaceX Launches, Lands 1st Reused Falcon 9 Rocket]

As the first orbital rocket to be re-flown, the Falcon 9 first stage represents an "incredible milestone in the history of space," said Musk.

The 15-story-tall rocket stage carries significance, though, beyond its latest feat. It was first used to launch a SpaceX Dragon cargo spacecraft to the International Space Station in April 2016, when it became the company's first booster to land on a drone ship after several earlier failed attempts.

To date, SpaceX has landed seven stages — not counting Thursday's encore landing — including four on a ship and three on a concrete pad at the Cape. SpaceX sees airline-like, full and rapid reusability as being vital to reducing the cost of launching to space and is working towards the day when "flight-proven" rockets are not unusual.

"The goal is to make this normal," said Musk. "Like, 'What are you talking about? Of course this thing comes back and lands. Why wouldn't it?'"

A new Falcon 9 rocket costs $62 million, but the cost of its fuel is only $200,000 to $300,000. If the first stages can be routinely reused, with no refurbishment between missions, then the cost to launch could be reduced on the order of a hundred-fold, said Musk.

"The architecture of the Falcon 9 rocket will certainly allow for a dramatic reduction in the cost of access to space," he said.

SpaceX designed the Falcon 9 with reusability as a part of its objective.

"The rocket can be re-flown, with zero hardware changes, the only thing that changes is you reload the propellant, 10 times," stated Musk. "With moderate refurbishing that does not have a significant effect on the cost, it can be re-flown at least 100 times."

SpaceX's Falcon 9 first stage is seen after successfully landing on a drone ship in the Atlantic Ocean in April 2016. Credit: SpaceX

For Thursday's launch though, Musk took no chances.

"With this being the first re-flight, we were being incredibly paranoid with everything. The core airframe remained the same, the [nine Merlin] engines remained the same, but any auxiliary components that we thought might be slightly questionable we changed out," described Musk.

The recovered stage will become the second of SpaceX's rockets to be put on display. The company erected its first-ever recovered booster outside of its Hawthorne, California headquarters and manufacturing facility in August 2016.
Musk was not specific when he said the first reused stage would go to the Cape.

SpaceX's launch control center is located just outside the main gates to the Cape Canaveral Air Force Station and adjacent to the Air Force Space and Missile Museum's Sands Space History Center, but if that is where the stage will be put on display is yet to be seen, if not also decided.

Wherever it ends up going, it will not be the only Falcon 9 rocket first stage at the Cape.

"The future ones will probably remain at the Cape, too — but just be flying a lot. We'll be building up the space fleet, basically," said Musk.

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NASA TESTS ENGINES THAT REDUCE DRAG AND FUEL BURN

Wednesday, 29 March 2017
http://www.aerodefensetech.com/component/content/article/26597?eid=376878189&bid=1712895

Boundary Layer Ingestion (BLI) is a promising idea NASA researchers are studying to reduce fuel burn in jet engines, thus reducing emissions and the cost of operating the aircraft. Thrust makes an airplane go forward, while drag tries to slow it down. Lift offsets the weight to keep an airplane in the sky. BLI deals specifically with the drag part of the equation by trying to reduce the total drag an airplane experiences in the sky.

Inside the 8' x 6' wind tunnel at NASA Glenn, engineers test a fan and inlet design, commonly called a propulsor. [NASA, Rami Daud (Alcyon Technical Services)]

When the airplane's engines are put at the extreme rear of the airplane, the slower, boundary layer air is ingested into the engine and is then accelerated with the rest of the air passing through the engine and exhausted out the back. With less

total drag, the engines need less thrust to push the airplane forward, which means they don't have to burn as much fuel.

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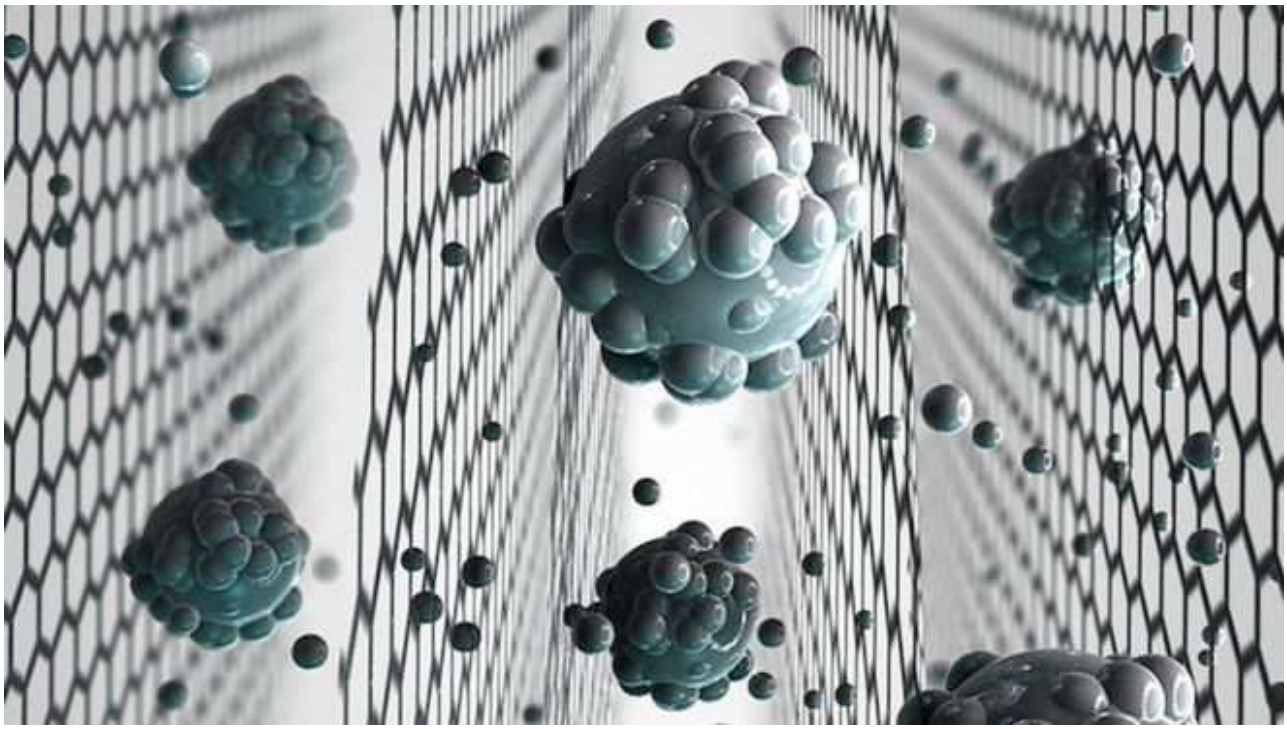
GRAPHENE-BASED SIEVE TURNS SEAWATER INTO DRINKING WATER

By Paul RinconScience editor, BBC News website, 3 April 2017
http://www.bbc.com/news/science-environment-39482342



UNI MANCHESTER - Graphene-based membranes hold huge promise in desalination

A UK-based team of researchers has created a graphene-based sieve capable of removing salt from seawater.

The sought-after development could aid the millions of people without ready access to clean drinking water.

The promising graphene oxide sieve could be highly efficient at filtering salts, and will now be tested against existing desalination membranes.

It has previously been difficult to manufacture graphene-based barriers on an industrial scale.
Reporting their results in the journal Nature Nanotechnology, scientists from the University of Manchester, led by Dr Rahul Nair, show how they solved some of the challenges by using a chemical derivative called graphene oxide.

Isolated and characterised by a University of Manchester-led team in 2004, graphene comprises a single layer of carbon atoms arranged in a hexagonal lattice. Its unusual

properties, such as extraordinary tensile strength and electrical conductivity, have earmarked it as one of the most promising materials for future applications.

But it has been difficult to produce large quantities of single-layer graphene using existing methods, such as chemical vapour deposition (CVD). Current production routes are also quite costly.

On the other hand, said Dr Nair, "graphene oxide can be produced by simple oxidation in the lab".

He told BBC News: "As an ink or solution, we can compose it on a substrate or porous material. Then we can use it as a membrane.

"In terms of scalability and the cost of the material, graphene oxide has a potential advantage over single-layered graphene."

EPA - Access to clean water remains a major issue for millions of people around the world

Of the single-layer graphene he added: "To make it permeable, you need to drill small holes in the membrane. But if the hole size is larger than one nanometre, the salts go through that hole. You have to make a membrane with a very uniform less-than-one-nanometre hole size to make it useful for desalination. It is a really challenging job."

Graphene oxide membranes have already proven their worth in sieving out small nanoparticles, organic molecules and even large salts. But until now, they couldn't be used to filter out common salts, which require even smaller sieves.

Previous work had shown that graphene oxide membranes became slightly swollen when immersed in water, allowing smaller salts to flow through the pores along with water molecules.

Now, Dr Nair and colleagues demonstrated that placing walls made of epoxy resin (a substance used in coatings and glues) on either side of the graphene oxide membrane was sufficient to stop the expansion.

Restricting the swelling in this way also allowed the scientists to tune the properties of the membrane, letting through less or more common salt for example.

When common salts are dissolved in water, they always form a "shell" of water molecules around the salt molecules.

This allows the tiny capillaries of the graphene-oxide membranes to block the salt from flowing through along with the water.

"Water molecules can go through individually, but sodium chloride cannot. It always needs the help of the water molecules. The size of the shell of water around the salt is larger than the channel size, so it cannot go through," said Dr Nair.

PHOTOSTOCK-ISRAEL/SCIENCE PHOTO LIBRARY - The scientists plan to test the graphene oxide sieve against existing industrial membranes used in desalination

By contrast, water molecules flow exceptionally fast through the membrane barrier, which makes it ideal for use in desalination.

"When the capillary size is around one nanometre, which is very close to the size of the water molecule, those molecules form a nice interconnected arrangement like a train," Dr Nair explained.

"That makes the movement of water faster: if you push harder on one side, the molecules all move on the other side because of the hydrogen bonds between them. You can only get that situation if the channel size is very small."

By 2025 the UN expects that 14% of the world's population will encounter water scarcity. As the effects of climate change continue to reduce urban water supplies, wealthy modern countries are also investing in desalination technologies.

Current desalination plants around the world use polymer-based membranes.

"This is our first demonstration that we can control the spacing [of pores in the membrane] and that we can do desalination, which was not possible before. The next step is to compare this with the state-of-the-art material available on the market," said Dr Nair.

In a news and views article accompanying the study in Nature Nanotechnology, Ram Devanathan, from the Pacific Northwest National Laboratory in Richland, US, said more work needed to be done to produce graphene oxide membranes inexpensively at industrial scales.

He added that scientists also needed to demonstrate the durability of the membranes under prolonged contact with seawater and ensure the membrane was resistant to "fouling" by salts and biological material (which requires existing barriers to be periodically cleaned or replaced).

"The selective separation of water molecules from ions by physical restriction of interlayer spacing opens the door to the synthesis of inexpensive membranes for desalination," wrote Dr Devanathan.

"The ultimate goal is to create a filtration device that will produce potable water from seawater or wastewater with minimal energy input."

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From: "Chris Cowan" <cowanc1028@earthlink.net>

RESEARCHERS SOLVE CRITICAL FLAW IN LITHIUM–SULFUR BATTERIES

Scientists have created a thin composite film that gives lithium–sulfur cells exceptional durability

By Umair Irfan, ClimateWire on March 21, 2017
https://www.scientificamerican.com/article/researchers-solve-critical-flaw-in-lithium-sulfur-batteries/?WT.mc_id=send-to-friend

Researchers have developed a new component that could heal the Achilles' heel of lithium-sulfur batteries.

Compared to the common lithium-ion battery (pictured above), lithium-sulfur batteries have important advantages, including cheaper materials and increased energy density. Credit: Kristoferb Wikimedia (CC BY-SA 3.0)

Compared to the common lithium-ion battery, lithium-sulfur batteries have important advantages: They use cheaper materials and weigh less. A lithium-sulfur cell can have almost double the energy of a lithium-ion cell for the same mass, yielding an edge where energy density is critical, like in portable electronics or in cars.

Improving energy density and cutting costs in energy storage are important steps in reducing greenhouse gas emissions from transportation and energy production.

However, over a few charge and discharge cycles, lithium-sulfur batteries gradually become unstable, and their electrodes break down, a flaw that has kept them from taking the energy storage throne.

In particular, ions of lithium react with sulfur to form compounds that migrate and reduce the capacity of the cell.

"When this happens, they clog the surface and prevent the lithium from getting within the cathode," said Victor Batista, a professor of chemistry at Yale University.

Previous efforts to stabilize lithium-sulfur batteries involved protective coatings that added to the weight of the device and made other significant performance trade-offs.

In a study published yesterday in the journal Proceedings of the National Academy of Sciences, Batista and his collaborators unveiled a thin composite film that gave lithium-sulfur batteries exceptional durability.

The researchers first simulated what kinds of materials and structures would work well to make lithium-sulfur cells last longer, computing how molecules in the cathode would interact with different materials.

The team then made the film from graphene, a one-atom-thick carbon structure, and an organic dendrimer, a polymer that has a tree-like branching structure. Results showed that the film had an average thickness of 90 nanometers.

The film kept the lithium-sulfur compounds together in one place, preventing them from leaching into the electrolyte and degrading the cell's performance. With this mechanism, scientists showed that they were able to extend the cycle life of the lithium-sulfur cell without compromising its performance.

"The amazing thing is that with these materials, we were able to make batteries that have a record of stability with a minimum amount of membrane," Batista said.

Co-author Jianbing Jiang, a postdoctoral researcher at the Energy Sciences Institute at Yale University, noted that the composite film was made from commercially available starting materials, which would make it cheap and easy to scale up.

"Theoretically, the preparation of this material is quite easy and straightforward," he said.

The researchers noted that they are still in the preliminary stages of this work and are now working on ways to improve the performance of lithium-sulfur batteries even further. "From there, we can design new materials with even better performance," said co-author Ke Yang, also a postdoctoral researcher at the Energy Sciences Institute.

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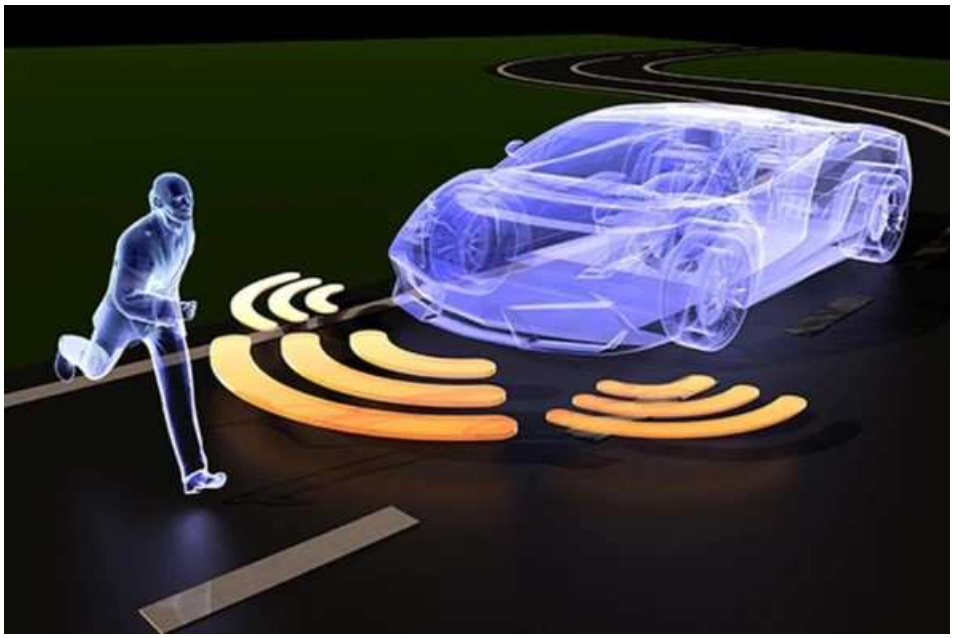
HOW PEDESTRIANS WILL DEFEAT AUTONOMOUS VEHICLES

The 'game of chicken' which could be a serious problem for driverless cars

By Karinna Hurley on March 21, 2017
https://www.scientificamerican.com/article/how-pedestrians-will-defeat-autonomous-vehicles/?WT.mc_id=send-to-friend



Credit: Devrimb Getty Images

Stand at any corner along via del Babuino and it won't be hard to tell the locals from the tourists. The guidebook holders navigate the swirling vespas and honking Fiats with a mix of hesitation and mad dashing, while the neighborhood residents cross with relative ease; assertive and calm.

And it's not just in Rome: in cities around the world local pedestrians, with a different sense of how drivers will behave, stand apart from occasional visitors. Unless you are on an isolated country road, walking and driving are social interactions, and only residents come to know behavioral customs of their city.

But, a big change might be coming soon. Understanding the psychology of other road users — when and if they will yield — won't be helpful in cross-walk calculations when the other driver isn't a person. Self-driving cars are already on the way; by some projections autonomous capability could even be standard by 2030. As drivers, cars will behave differently than humans, and they will almost surely be programmed to avoid hitting people. The idea that roads will become safer, with fewer traffic accidents, is a driving force behind the new technology. But, as pedestrians quickly figure out the cars' behavior, they will certainly adapt theirs as well. The effects could be dramatic: instead of more consistent, traffic flow could become chaotic.

A recently published paper in the Journal of Planning Education and Research explored how interactions between humans and self-driving cars could change the rules of the road. Author Adam Millard-Ball first explains a current model of how pedestrians decide when to cross the street. Each crossing involves a mental calculation: a choice between crossing as quickly as possible and risking being hit vs. waiting, for who knows how long, or even choosing a new route. Drivers also have a decision to make, to yield or not to yield. The set-up is a cross-walk game of chicken between driver and pedestrian. While intuitively it may seem that pedestrians, more likely to be hurt by a collision, would always yield first, their actions are in fact shaped by social norms. Drivers are likely to yield when hampered by busy traffic or, for example, unpredictable tourists. But, if the local norm is always for pedestrians to wait, the risk of crossing is greater and waiting then makes even more sense.

In a game of cross-walk chicken with a self-driving car, things will be very different. Unlike people, cars will always act predictably; no temptation to glance at a cell phone, need to break-up a fight between squabbling toddlers, or attempts to balance a steering wheel and a drive-through burger. And, cars will almost surely be programed to avoid hitting people. Local customs will be irrelevant; pedestrians will be up against exclusively law-abiding yielders — no matter the corner or block, the pedestrians will have the psychological upper-hand. With full confidence cars will yield, they can be emboldened crossers, even in situations when they do not have the right-of-way. Humans will be free to take advantage of cars.

Millard-Ball outlines three possibilities for how new human-car interactions will alter the roads of the future, starting with pedestrian supremacy. In this scenario, if you need to get somewhere within the center of town you'll probably go by foot. Your car can drop you off on the outskirts, but will effectively be curbed in urban areas as pedestrians' impunity to cross streets at their convenience could potentially slow car traffic to a halt. The density of urban areas will continue to increase as walking becomes more efficient than driving.

In the regulatory response outcome, pedestrians will still think twice about crossing the street, but instead of focusing on the risk of being hit by a car, being hit with a potential traffic ticket will come to mind. Attempts to reign in pedestrians could come through a combination of new regulations and infrastructure designed to keep people and cars separated. Planning focused on shared spaces for cars and people will decline and fences and road barriers will increase. Liability for pedestrian-car accidents would primarily fall on

the (now) law-breaking pedestrians, and not car manufacturers, further constraining their behavior.

Finally, according to a human driver scenario, the slower travel time incurred by using a self-driving car would outweigh the benefits of a passenger lifestyle. The freedom to check-your email, call-in on a business meeting, or watch Netflix on the drive to work simply won't be worth taking the extra travel time to get there. Indeed, retaining the advantage in the game of crosswalk chicken will override the convenience of being driven. But, pedestrian-oriented designs only makes sense if most vehicles drive themselves. Ultimately, how neighborhoods evolve to accommodate and incorporate self-driving cars will depend on all the various policy, legal, and technological factors.

No matter what scenario prevails, transportation in the future will likely be shaped by the ability of humans to exploit the driverless machines.

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CYBORGS AT WORK: EMPLOYEES GETTING IMPLANTED WITH MICROCHIPS

By JAMES BROOKS, From Associated Press, April 03, 2017 7:58 AM EST
http://my.earthlink.net/article/top?guid=20170403/fab8fe9a-ebe6-445c-a312-d4ae5768a565

Self-described "body hacker" Jowan Osterlund from Biohax Sweden, holds a small microchip implant, similar to those implanted into workers at the Epicenter digital innovation business centre during a party at the co-working space in central Stockholm, Tuesday March 14, 2017. Microchips are being implanted into volunteers to help them open doors and operate office equipment, and its become so popular that members of the Epicentre cyborg club hold regular parties for those with the tiny chips embedded in their hands. (AP Photo - James Brooks)

STOCKHOLM (AP) — The syringe slides in between the thumb and index finger. Then, with a click, a microchip is injected in the employee's hand. Another "cyborg" is created.

What could pass for a dystopian vision of the workplace is almost routine at the Swedish startup hub Epicenter. The company offers to implant its workers and startup members with microchips the size of grains of rice that function as swipe cards: to open doors, operate printers, or buy smoothies with a wave of the hand.

The injections have become so popular that workers at Epicenter hold parties for those willing to get implanted.

"The biggest benefit I think is convenience," said Patrick Mesterton, co-founder and CEO of Epicenter. As a demonstration, he unlocks a door by merely waving near it. "It basically replaces a lot of things you have, other communication devices, whether it be credit cards or keys."

The technology in itself is not new. Such chips are used as virtual collar plates for pets. Companies use them to track deliveries. It's just never been used to tag employees on a broad scale before. Epicenter and a handful of other companies are the first to make chip implants broadly available.

And as with most new technologies, it raises security and privacy issues. While biologically safe, the data generated by the chips can show how often an employee comes to work or what they buy. Unlike company swipe cards or smartphones, which can generate the same data, a person cannot easily separate themselves from the chip.

"Of course, putting things into your body is quite a big step to do and it was even for me at first," said Mesterton, remembering how he initially had had doubts.

"But then on the other hand, I mean, people have been implanting things into their body, like pacemakers and stuff to control your heart," he said. "That's a way, way more serious thing than having a small chip that can actually communicate with devices."

Epicenter, which is home to more than 100 companies and some 2,000 workers, began implanting workers in January 2015. Now, about 150 workers have them. A company based in Belgium also offers its employees such implants, and there are isolated cases around the world where tech enthusiasts have tried this out in recent years.

The small implants use Near Field Communication (NFC) technology, the same as in contactless credit cards or mobile payments. When activated by a reader a few centimeters (inches) away, a small amount of data flows between the two devices via electromagnetic waves. The implants are "passive," meaning they contain information that other devices can read, but cannot read information themselves.
Ben Libberton, a microbiologist at Stockholm's Karolinska Institute, says hackers could conceivably gain huge swathes of information from embedded microchips. The ethical dilemmas will become bigger the more sophisticated the microchips become.

"The data that you could possibly get from a chip that is embedded in your body is a lot different from the data that you can get from a smartphone," he says. "Conceptually you could get data about your health, you could get data about your whereabouts, how often you're working, how long you're working, if you're taking toilet breaks and things like that."

Libberton said that if such data is collected, the big question remains of what happens to it, who uses it, and for what purpose.

So far, Epicenter's group of cyborgs doesn't seem too concerned.

"People ask me; 'Are you chipped?' and I say; 'Yes, why not,'" said Fredric Kaijser, the 47-year-old chief experience officer at Epicenter. "And they all get excited about privacy issues and what that means and so forth. And for me it's just a matter of I like to try new things and just see it as more of an enabler and what that would bring into the future."

The implants have become so popular that Epicenter workers stage monthly events where attendees have the option of being "chipped" for free.

That means visits from self-described "body hacker" Jowan Osterlund from Biohax Sweden who performs the "operation."

He injects the implants — using pre-loaded syringes — into the fleshy area of the hand, just next to the thumb. The process lasts a few seconds, and more often than not there are no screams and barely a drop of blood. "The next step for electronics is to move into the body," he says.

Sandra Haglof, 25, who works for Eventomatic, an events company that works with Epicenter, has had three piercings before, and her left hand barely shakes as Osterlund injects the small chip.

"I want to be part of the future," she laughs.

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From: "Jim Woosley" Jimwoosley@aol.com

BATTLE BETWEEN QUANTUM AND THERMODYNAMIC LAWS HEATS UP

Physicists try to rebuild the laws of heat and energy for processes at a quantum scale.

Davide Castelvecchi, 29 March 2017
http://www.nature.com/news/battle-between-quantum-and-thermodynamic-laws-heats-up-1.21720

Walter Scriptunas II

Steam engines convert heat into work; physicists are debating the rules that govern how quantum-level machines could do the same thing.

The young field of quantum thermodynamics, which tries to reconcile quantum theory with the 200-year-old science of heat and entropy, is booming. It's also causing some heated disputes.

Many physicists hope that rebuilding thermodynamics from the laws of quantum mechanics will help to settle long-debated conundrums. There are practical implications, too. The field could help to resolve whether the concepts of heat and efficiency apply to tiny electronic components and even atom-sized machines.

But despite proliferating approaches — many of which were presented at the Fifth Quantum Thermodynamics Conference this month in Oxford, UK — the field is as contentious as ever. The crux of the issue is whether the fundamental laws that govern heat and energy on large scales also dictate the behaviour of nanoscale systems — or whether new laws are needed.

Interest is growing: this year, more than 100 scientists attended the quantum thermodynamics conference, says co-organizer Vlatko Vedral, a physicist at the University of Oxford. That is double the attendance in previous years.

Such meetings bring together researchers from subfields that use different technical languages, says co-organizer Felix Binder, a theoretician at Nanyang Technological University in Singapore. "There are a lot of barriers being broken between different approaches."

But a few physicists, such as Peter Hänggi of the University of Augsburg, Germany, caution that some of the work is misguided. "The field is growing rapidly, but also a lot of nonsense is written (and talked) about," he says.

Physicists have argued over the meaning of the three laws of thermodynamics since they were written in the nineteenth and early twentieth centuries. The laws say that energy cannot be created or destroyed; that the amount of disorder, or entropy, in an isolated system can never decrease; and that it is impossible to cool an object to absolute zero. But thermo-dynamics is paradoxical. The second law, which also puts limits on how efficiently heat can be converted into work — as happens in a steam engine — is particularly controversial.

The law says that the production of disorder is irreversible. But some physicists argue that at the microscopic level, this seems to conflict with the laws of mechanics — be they those of Newton or of quantum physics. Mechanical laws, say these researchers, prescribe that all processes can be reversed.
"This has always been a bit of a dirty business."

Researchers have come up with different approaches to solving this conundrum, but none has satisfied everyone. "This has always been a bit of a dirty business," says Christian Gogolin, a physicist at the Institute of Photonic Sciences in Castelldefels, Spain.

Gogolin's work involves taking statistical mechanics, in which quantities such as temperature or heat are averaged properties of systems made of many particles, and

developing a quantum version of it. Some physicists maintain that this statistical-mechanics approach suggests that quantities such as entropy or heat depend on the information an observer possesses. In particular, an all-seeing, 'godlike' being could know the positions and motions of each particle and calculate their evolution, and this level of order would be in the eye of the beholder.

This approach has been revived in recent years, as many physicists have come to regard information as something quantifiable, and with physical significance.

Statistical mechanics is even murkier in systems made of relatively few particles and governed by quantum laws. For example, if the tendency towards disorder is a purely statistical phenomenon, it might in principle not apply to a single molecule. Yet in the past decade, theorists have suggested that quantum systems tend to reach and maintain a state of equilibrium — or maximum disorder — even when they have just a handful of components. Experiments confirmed this with small numbers of atoms trapped by laser light in a vacuum1.

And in a 2011 theory paper in Nature, Vedral and his collaborators showed that quantum correlations — the ability of particles to share an 'entangled' quantum state when far apart — can be harnessed to produce mechanical work2.

More recently, physicists have made progress with the third law. In a paper published on 14 March in Nature Communications3, Lluis Masanes and Jonathan Oppenheim at University College London showed that the laws of quantum mechanics limit how fast heat can be extracted from an object, and that reaching absolute zero would take an infinite amount of time. Their work seems to confirm that the third law emerges from quantum mechanics.

A more radical proposal, by Oxford theoretical physicists Chiara Marletto and David Deutsch, suggests a set of principles that all physics theories have to satisfy, a sort of a 'theory of everything' from which laws such as quantum mechanics should follow. And in a 2016 preprint4, Marletto sketched out how this set of meta-laws leads to a redefiniton of thermodynamic concepts in terms of rules that physical transformations have to obey.

Whatever the outcome of these debates, they may have implications for future technologies. Physicists have made 'quantum heat engines' — that can turn heat into work at the quantum level5. Applications such as quantum computing are moving from the theoretical to the real world, so understanding thermodynamics on a tiny scale could be crucial. "You need to design algorithms that are not just faster," says Renner, "but also thermodynamically optimized."

Nature 543, 597–598 (30 March 2017) doi:10.1038/543597a

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From: "Tedd Roberts" s2la@teddroberts.com

MEMORY PROSTHETICS SHOW PROMISE IN HELPING THOSE WITH NEURODEGENERATIVE DISORDERS.

*** January/February 2017**
http://pulse.embs.org/january-2017/committing-to-memory/

Cell phone chimes, sticky notes, even the proverbial string around a finger—these timehonored external cues help guard against our inevitable memory lapses. But some internal help to the brain itself may be on the way in the form of what's being called memory prosthetics. Once considered to be on the fringes of neuroscience, the idea of adding hardware to the brain to help with memory has gathered steam. In 2014, the U.S. Defense Advanced Research Projects Agency (DARPA) made a US$30 million investment in memory prosthetic research as part of the Obama administration's Brain Research through Advancing Innovative Neurotechnologies initiative. In August 2016, Kernel, a startup based in Los Angeles, California, announced its goal to develop a clinical memory device for those debilitated by neurodegenerative disorders such as Alzheimer's disease.

Justin Sanchez

"We are trying to think about new neurotechnologies that could be used to help individuals form and recall memories again," says Justin Sanchez (Figure 1, right), program director of DARPA's Restoring Active Memory (RAM) project. The project was motivated by the numbers of military personnel who experience memory impairments associated with traumatic brain injury (TBI). The plan is to demonstrate by 2018 that the implantable device can restore the ability to form and recall memories in human clinical populations.

In fact, the age of the bionic brain has already arrived. Other neural prosthetics allow paralyzed people to move robotic limbs, deaf people to hear through cochlear implants, and those with epilepsy to avoid seizures. In each case, the device interacts directly with the brain, substituting or compensating for a damaged component. Researchers hope to apply this to memory circuitry, which degrades precipitously in Alzheimer's disease or can

be damaged by TBI, making it difficult for people to take care of themselves and straining both families and the healthcare system. The number of individuals living with severe memory impairments is growing; 270,000 people in the military have been diagnosed with TBI since 2000, and Alzheimer's disease diagnoses are projected to reach 13.8 million by 2050.

Yet, within a decade, hardwired help may be on the way. Engineers, neurologists, and neuroscientists have teamed up to develop memory prosthetics that precisely inject electrical current to shore up memory circuits. A clinical trial of people with mild Alzheimer's disease has found that deep brain stimulation (DBS) of one brain region can keep memory circuitry online (Figure 2). In another approach, two DARPA-funded projects aim to strengthen memory by firming up the initial formation, or encoding, of a memory. This involves a device that can sense when the ongoing chatter of neurons is less than necessary to encode a memory and then bump up neural activity accordingly. Such devices consist of tabletop versions now, but researchers are striving to make them fully implantable. The efforts are pushing the limits of understanding human memory and electronics alike.

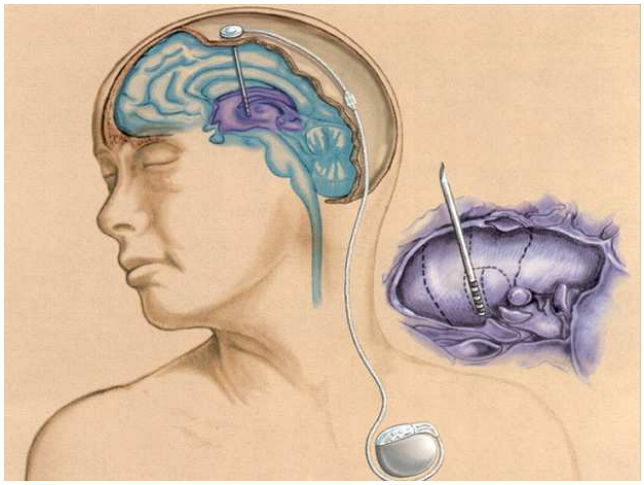

Figure 2: With DBS, an electrode is implanted into the brain to deliver electrical signals driven by a battery-powered stimulator placed underneath the skin. (Image courtesy of Andres Lozano.)

"There's virtually no part of the memory circuit that we're not investigating here," Sanchez says. "That's important because, when it comes to human memory, we don't know all of the specific circuits that are involved in memory formation and recall, so we're learning about human memory while we're developing the prosthetics for restoring memory." Memory prosthetics could target ailing circuitry with more precision than drugs. "A pharmaceutical pretty much bathes the brain and the body in the chemical," Sanchez continues. "That's why the device approach, which would allow us to directly interact with the specific neurons involved in memory formation and recall, is a direction we aim to go."

KEEPING MEMORY NETWORKS ONLINE

A memory is formed by a network of brain regions centered around the hippocampus. Experiences, such as meeting a new person, result in patterned electrical activity in the hippocampus, which then sends pulses to other parts of the brain to store a memory. When we see that person again a few days later, the circuit kicks in to retrieve the memory and deliver recognition. But the involvement of multiple brain regions, as well as precise patterns of activity, makes it difficult to know how best to tinker with the electrical messages passed around by this network in a way that shores up memory.

Nevertheless, there are signs that it can be done. In 2012, researchers at the University of California, Los Angeles, reported that DBS to the entorhinal cortex, a region that plugs information into the hippocampus, could enhance memory in humans [1]. The researchers studied seven people with intractable epilepsy, all of whom had received temporary

implants of electrodes into their brains, to help doctors identify the seizure-prone regions that needed to be surgically removed. This required monitoring brain activity for many days, during which researchers could study memory while the patients navigated a virtual environment. If milliamp stimulation was applied when a patient encountered a particular virtual location for the first time, in later trials the patient could find that location more quickly and accurately.

Andres Lozano

This demonstrated gains in normal memory, but Andres Lozano (Figure 3, right), a neurosurgeon at the University of Toronto in Canada, has begun to explore DBS as a way to save brain function in people with mild Alzheimer's disease. Although an electrode implanted into the brain might seem drastic at the early stages of illness, it's worth the risk to some. "The average survival after an Alzheimer's diagnosis is on the order of six to nine years, and you will die of your dementia," Lozano says. "Patients who do not accept that are the ones that are the most keen to undergo this investigational procedure."

Lozano and his colleagues have shown that as Alzheimer's disease progresses, different parts of the brain shut down in a characteristic sequence. In a small phase 2 clinical trial, Lozano found that applying DBS to the fornix, which conveys signals coming out of the hippocampus, could revive dormant parts of the brain. After a year of continuous stimulation, no adverse effects were reported, but no clear sign of memory enhancement was seen either. "If we get these brain areas to turn back on again, that might mean that their function could return, and that might lead to improvement in Alzheimer's disease," Lozano explains, noting that a phase 3 trial is being planned.

COMPUTING MEMORY

Another way to boost memory is to create stronger memories in the first place. To explore this possibility, two separate DARPA-funded research groups participating in the RAM project are developing devices that both read out ongoing brain activity and write in signals as needed. This requires electrodes to monitor neural activity, a microprocessor to analyze these signals, and a stimulator to send current back through the electrodes.

One group's device is meant to mimic the function of the hippocampus itself. "We've tapped into the hippocampus because we think that almost anything that needs to be remembered will be represented in that structure in some way," says Sam Deadwyler, a neuroscientist at Wake Forest Baptist Medical Center in Winston-Salem, North Carolina. Deadwyler and Robert Hampson (Figure 4), also at Wake Forest, have teamed up with Theodore Berger and Dong Song at the University of Southern California, Los Angeles, to develop their device. Their research stems from experiments begun more than 20 years ago, which revealed that certain patterns of hippocampal activity marked strong versus weak encoding states when rats did a memory task.

Specifically, rats were presented with a lever that they pressed to receive a reward (the encoding phase). The lever then retracted, and, after a delay, two levers emerged. The rat then had to choose the lever that it had not pressed, thus retrieving its memory. The researchers realized that during encoding, activity in the hippocampus reflected whether

the rat would later remember the lever during the retrieval phase. "We could identify what we called strong codes and weak codes. Strong codes would result in correct performance, weak codes would result in errors," Hampson says. "Then our question became, 'could we make weak codes strong?'"

Figure 4: Sam Deadwyler (left) and Robert Hampson (right), researchers at Wake Forest Baptist Medical Center in Winston-Salem, North Carolina, are applying more than 20 years of memory research in rodents to build a device to aid human memory.

They teamed up with Berger and Song, who had developed a multiple-input, multiple-output (MIMO) computer model of information processing in the hippocampus. This MIMO algorithm could take in information from many different neurons and predict their effect on the neurons receiving the information. For Deadwyler and Hampson, this meant that the algorithm could translate a message passed between the CA3 and CA1 subregions of the hippocampus, thus allowing their device to deliver the needed electrical signals to produce strong encoding in CA1. In fact, introducing stimulation when the MIMO model detected weak encoding improved rat performance under normal conditions and when hippocampus function was hobbled pharmaceutically [2]. Because the device is meant to embody hippocampal computations, it should work for anything that the hippocampus might process, no matter the event or task. New work in monkeys supports this: stimulation during weak encoding aided memory, whether for an object or its location [3].

Deadwyler and Hampson foresee a clinical trial of their memory prosthetic in five to ten years, and they have begun experiments in people with epilepsy awaiting surgery. Researchers consider such memory prosthetics to be as safe as DBS electrodes, which have been used for 30 years. The currents delivered to the brain are well below levels that can cause damage. Furthermore, because the device is meant to stand in for the

hippocampus, it is unlikely to encode unnecessary information, Hampson says. "Our goal with the neural prosthetic is not to input specific information code patterns to the brain, but rather to create a device which 'bypasses' a damaged hippocampus by performing the same processing functions that an intact hippocampus would perform in the same context."

MEMORY MAPPING

Daniel Rizzuto

The second RAM project research group, run by Michael Kahana at the University of Pennsylvania in Philadelphia, is also studying memory in an epilepsy patient population, but with consideration of the contributions of additional brain regions. Because electrodes are placed in the brain based on where doctors believe the seizures to originate, they sample beyond the known memory network. This approach has allowed unprecedented access to the machinations of the human brain: in two years, the group has enrolled more than 200 people with implanted electrodes, conducted upward of 1,000 memory-mapping sessions, and collected data from more than 20,000 electrode contacts. The research builds on the work of Kahana and Daniel Rizzuto (Figure 5, right), also at the University of Pennsylvania, who have identified neural signatures of good memory performance in humans. Their device will use stimulation to encourage an optimal brain state for forming memories—similar to being "in the zone" during our daily lives, Rizzuto says.

For example, in a memory task called a delayed-recall task, a person studies a list of words and is then asked to recall those words minutes later. For the RAM project, the researchers have trained a machine-learning classifier to interpret patterns of brain activity while a person studies—that is, encodes—the word list. Preliminary results suggest that the classifier can predict with some accuracy whether or not a word will be remembered. Stimulation can also modulate memory, for better or worse. "If stimulation arrives when the brain is working well, it tends to impair performance," Rizzuto says. "If the brain is in a poor state, stimulation tends to boost performance. This tells us that timing of stimulation is critically important" (Figure 6).

Researchers are beginning to do closed-loop experiments in which stimulation is delivered as needed, when the classifier deems encoding to be weak. This means data from the brain need to be read out and signals sent back into the brain within around 100 milliseconds, according to Rizzuto.

Ultimately, DARPA wants a fully implantable, wireless device, but, for now, the RAM projects are working with tabletop versions. For example, the hardware developed by Rizzuto's group fills a rack that must be wheeled in next to the patient's bedside and plugged into the wires coming from the patient's brain. But miniaturization is on the horizon: their next-generation device is the size of a stack of five iPhones. Eventually, the device could be implanted underneath the skull and powered through the skin, maybe through a cap or a pillow. Improvements in the electrodes may also give finer resolution of brain activity and more informative signals.

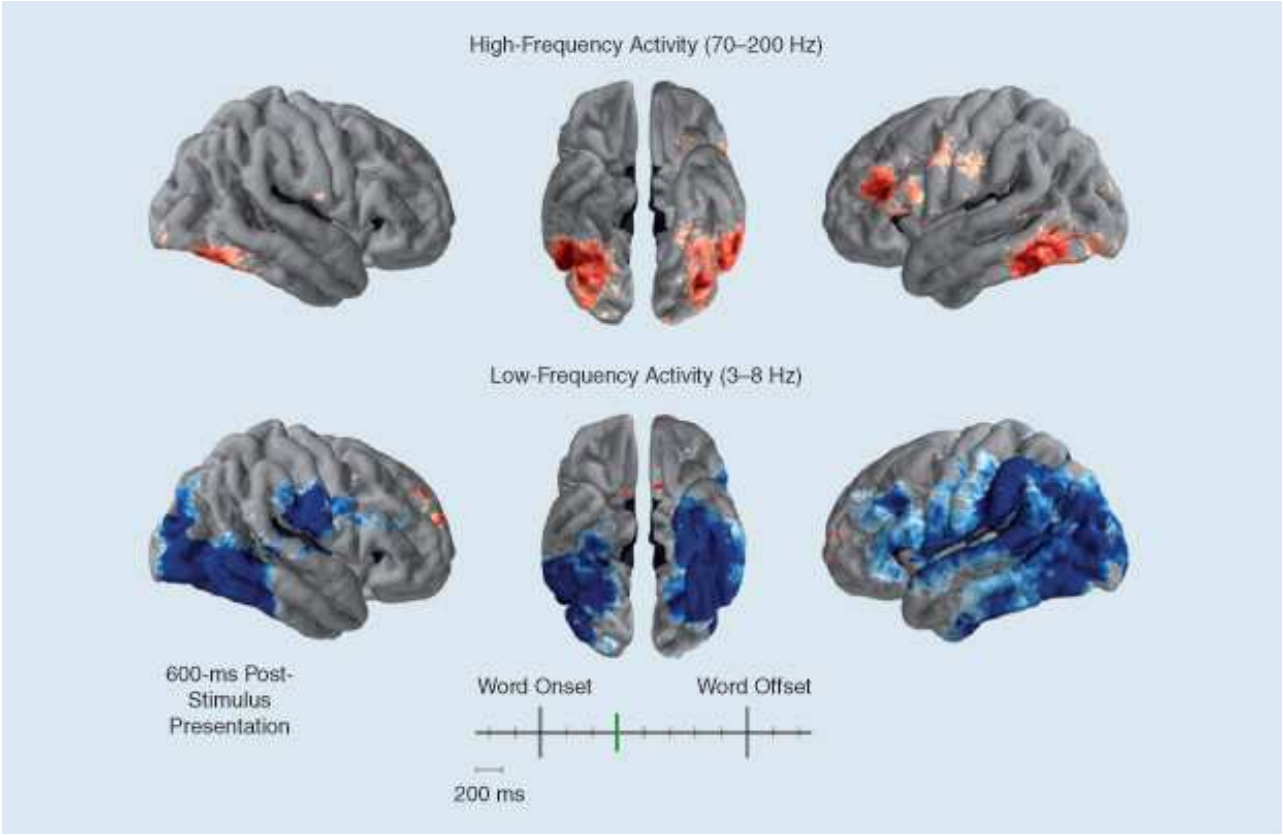

Figure 6: The brain's biomarkers in an optimal encoding state: high-frequency brain waves increase (red), and low-frequency waves decrease (blue). (Image courtesy of James Kragle.)

The required electronics to collect high-fidelity signals from thousands to millions of neurons, amplify and interpret them, and then send precise stimulation back to the neurons—all in a small, portable package—don't necessarily exist yet. "There's a huge list of technological developments that needs to be accomplished in order to make this work," Sanchez says. Whether insights from these memory-mapping sessions will prove helpful to a memory-impaired person remains to be seen. But, as Rizzuto notes, "We are optimistic that the tasks we're using will translate very well to the clinical population in a more ecologically valid type of setting, like when they're at home trying to remember what's on the grocery list or where they are going."

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